DISCOVERY

A Monthly Popular Journal of Knowledge

Vol. VIII, No. 94. OCTOBER, 1927. PRICE 1s. NET

RUINS OF PALMYRA IN THE SYRIAN DESERT

CONTENTS.

	Pages
Editorial Notes	309
Rearing a Crab	311
The Ruins of Palmyra	314
Bird-Migration	318
"Letters of Gertrude Bell" ...	321
The British Association... ...	325
The Month in Brief	331
A History of Beads	332
Treatment of Infection	336
Wireless Developments... ...	338
Among the Stars...	339
Correspondence	340
Book Reviews	343

DISCOVERY

A Monthly Popular Journal of Knowledge

Vol. VIII, No. 94. OCTOBER, 1927. PRICE 1s. NET

Trustees: Sir J. J. Thomson, O.M., F.R.S., Sir F. G. Kenyon, K.C.B., F.B.A., Professor A. C. Seward, Sc.D., F.R.S., Professor R. S. Conway, Litt.D., F.B.A.

Edited by John A. Benn.

Publishers: Benn Brothers, Ltd. All communications respecting editorial matters to be addressed to the Editor; all questions of advertisements and subscriptions to the Manager.

Offices: Bouverie House, Fleet Street, London, E.C.4.

Telephone: City 0244 (10 lines).

Telegrams: Benbrolish Fleet.

Annual Subscription, 12*s.* 6*d.* post free anywhere in the world. Single numbers, 1*s.* net; postage 2*d.*

Binding cases for Vol. VII, 1926, can still be obtained. Price 2*s.* 6*d.* net each; postage 6*d.*

Editorial Notes.

Our suggestion last month that the presidential address to the British Association would not lead to bitter discussion has been substantiated, notwithstanding the attempts of certain "stunt" journalists to revive the evolution controversy. A reasoned correspondence in *The Times* was, however, opened with a criticism in which the theologian, Dr. Relton, asked whether the verdict for Darwinism in the strife over the Biblical account of man's creation was as definite as Sir Arthur Keith stated; yet his letter contained no argument which was necessarily to be interpreted as suggesting antagonism between science and religion, nor, for that matter, did the address criticized, whose author indeed subscribes to the opinion that there need be no such conflict. In taking exception to the priority of matter over mind in the time-space sequence, and to the necessary precedence of structure over function, Dr. Relton obscured his real question and exposed himself to the contrary evidence, in favour of this view of the practical course of evolution, which is afforded by flints. As Mr. Reid Moir stated, when the differing types of stone artifacts are traced back into the remote past, we find them becoming ever simpler and more primitive, and it is reasonable to suppose, reflecting the mentality of the people who made them. From the "spiritual" aspect, on the other hand, to use his own term, Dr. Relton was not provoking controversy so far as he was citing what is after all the most elementary lesson of science, the presence of order and design in the universe.

Sixty years ago the victory of the scientist over the theologian was made easy by the fact that Protestantism at that time, having thrown over ecclesiastical authority as its standard of literal truth was then clinging to the Bible, which implied acceptance of the *Genesis* story of creation as literally true. As this untenable position is no longer held, the boot is now on the other leg, Dr. Relton asking whether the scientist on his part still holds literally that man is only different in degree, and not in kind, from other forms of life, as is suggested if Darwinism is to be regarded in itself as an entirely sufficient explanation for the existence of man. The theologian's criticism of the scientists, that is to say, is that they tend to assume a difference of degree only on utterly insufficient evidence, and to use their authority, so to speak as experts in the value of evidence, to get this assumption accepted. Though no doubt this is sometimes the case, the leading scientists of the day can hardly be accused of not keeping an open mind in regard to a problem where the evidence is, at the best, inconclusive. There need be no controversy between science and religion, so long as scientists confine themselves to established facts and theologians do not attempt to deny them.

* * * * *

The outstanding papers presented at Leeds are fully discussed on another page, but in view of the interest in polar research aroused by Dr. Rudmose Brown, it may be noted here that his conclusions on aerial exploration are supported by a recent lecture to the Royal Aeronautical Society. It may be assumed that the most favourable view of this new use of the aeroplane was presented to an audience of aviators, yet Mr. Scott Hall's lecture admitted that its disadvantages greatly outweigh the advantages in a branch of research which in the best of conditions must always be a hazardous one. By using aircraft in polar work one hundred miles may be covered in an hour as against a dozen miles in a day; it also enables mapping and surveying to be carried out speedily in combination with a small amount of ground co-operation. The disadvantages, on the other hand, are formidable, there being the danger of forced

landings, and also a far greater dependency on weather conditions than is the case when sledging. It is impossible to examine the earth's surface in detail without landing—a great drawback from the geological point of view—and landings are very undesirable in these regions; two-thirds of the surface are totally unfitted for the purpose, and even if a safe landing be made, it may be days before it becomes possible to take off again. The conclusion would seem to be that the aeroplane should not be used for purposes to which it is as yet unfitted, a fact which has been emphasised lately in connexion with long distance flying.

* * * * *

In face of the disaster which has met the most recent attempts to fly the Atlantic, there is considerable compensation in the success of the American airmen who afterwards proceeded to reach Japan, travelling eastwards from New York, in fourteen days. Public opinion in several countries has clearly expressed its disapproval of ocean flights attempted without proper precautions, and while credit must be paid to their judgment in abandoning the Pacific crossing, it detracts nothing from the romance of the efforts of Mr. Brock and Mr. Schlee to record quite frankly their shortcomings in this respect. According to Imperial Airways authorities, who examined the machine during its brief halt at Croydon, the maps used for the Atlantic part of the journey were so crude that it is doubtful if any long-distance flight has ever been carried out in such an apparently casual manner. The sea chart of the English Channel was on such a scale that no land names were marked on it, which explained the almost farcical events with which their first stage was completed.

* * * * *

A small boy playing on the South Devon coast was surprised by the sudden descent of a paper bag weighted with an orange, which on being read by an elder was found to contain a written request that the name of the town *and country* (the italics are ours) should be written on the sands. It next appears to have been surmized from the continued and confused circling of the aeroplane overhead that the sand message was ineffective, so someone wrote in chalk on the asphalte road behind the beach: "Seaton, Devon." Even after this the Americans were not sure of their whereabouts until a Union Jack was hoisted, but somehow or other they then found their way to London by compass. Our wireless correspondent this month makes a plea for enforcement of the Air Ministry's powers to ensure that ocean airmen carry wireless equipment. The success of the world flight, notwithstanding the circumstances just described, in our opinion emphasises that the precautionary legislation already proposed in Canada and Australia is fully justified. As a leading newspaper remarked in perhaps the best comment made on the present situation, the test question which every pilot must put to himself is: "How will my effort contribute to the future of aviation?"

* * * * *

It is to be hoped that the fullest support will be given to a new appeal for funds required to continue the excavations at Ur of the Chaldees. In a recent note we contrasted the plight of this British party with that of other liberally-endowed American expeditions; in the circular Mr. Leonard Woolley has just issued he draws attention to the fact that each British donation to the Ur fund assures a corresponding increase in the American contributions, and therefore has a double value. The excavations are being carried out under the joint auspices of the British Museum and the Museum of Pennsylvania University, who have worked on the site for five years. More than once the shortness of funds has made it necessary to close down work unduly early. Readers of our article in June will recall that unfortunately at the moment when the harvest of finds was at its richest last season, this thoroughly uneconomical course had to be adopted. The scientific exploration of such a site requires a full staff of experts, this in itself involving great expense in travelling. To balance these heavy "overhead" charges as many workmen as can be adequately supervised must be employed, so that the output will keep the staff fully at work as long as possible each winter. The two Museums bear equally the annual cost; £1,250 has to be raised by public subscription towards the 1927-28 fund, for which donations should be addressed to the Director, The British Museum, London, W.C.1.

* * * * *

In briefly noting last month that a new liquid fuel process had been evolved in Germany, we added no comment as its precise significance was difficult to gather from the particulars then available. Premature reports relating to the Bergius method for obtaining oil from coal have sometimes appeared in the past, but it is generally understood to be still impractical for commercial operation. The subsequent announcement that the new product is to be marketed in April next therefore suggests an entirely distinct process.

Researches on Rearing a Crab.

By Marie V. Lebour, D.Sc., F.Z.S.,

Naturalist at the Plymouth Marine Laboratory.

For the first time full details are available of the complete life-history of a spider crab, which the author has just succeeded in rearing from egg to young in a small aquarium. The illustrations are drawn to scale.

It is very difficult to rear crabs from the egg, and although this has occasionally been successfully accomplished, no details have ever been given of the process, and in most cases it was probably chance which brought the little crabs through the many larval stages before reaching the adult form. Researches have recently been undertaken by the writer in order to identify the numerous larval crabs which swarm in the upper water layers of the sea, and certain species have now been reared from egg to crab. An account of one of these is given below.

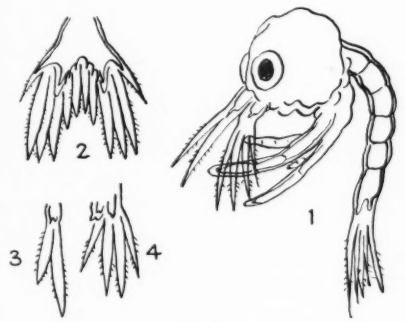


Fig. 1.
FORM IN WHICH THE EGG HATCHES.
This is known as a *pre-zoea* (1), being the first larval form of the crab covered by an embryonic skin. The hairy spines (2, 3 and 4) this skin bears are effective in its removal.

The species chosen is one of the smaller spider crabs commonly caught in the trawl, and known to science as *Inachus Dorsettensis*. Most spider crabs have a pronounced tendency to disguise themselves by dressing up in anything which surrounds them, placing pieces of seaweed, zoophytes, sponges—indeed, almost anything—by means of their claws on to the long curved spines which are scattered all over their bodies. The crab in its native haunts is thus difficult to see, as it usually looks like a tuft of seaweed or mass of sponge, and it is only when it moves that one sees its true nature.

The life-history of *Inachus Dorsettensis* was unknown until the present writer undertook to investigate it, and in the spring of this year published an account of it together with two other spider crabs (" Journal of the Marine Biological Association," XIV, 3, 1927). Even then, however, they were only brought as far as the last larval stage, and it was not until the summer that the rearing was complete from egg to crab. The young crabs are still alive in the aquarium, being about six weeks old and very vigorous.

It is well-known that the female crab carries her eggs under her body attached to some of the short hind legs, which are tucked in under the large shield or carapace. The eggs are present in enormous numbers, hundreds or even thousands being carried at one time. In the present case the eggs being fairly large a few hundreds is the usual number. The female crabs " in berry " (*i.e.*, carrying eggs) were collected and placed in glass aquaria, and the newly hatched young which rose to the surface and to the light were removed to another receptacle.

The now well-known apparatus used for rearing is the " plunger jar." This was invented by Mr. E. T. Browne and by Dr. E. J. Allen, Director of the Plymouth Marine Laboratory, and its principle is based on the fact that small organisms used to living floating in the sea need a certain amount of movement of the water. A " plunger " was therefore used consisting of a glass plate which moved vertically up and down in the aquarium and a regular stirring of the water was thus effected, the surface film being

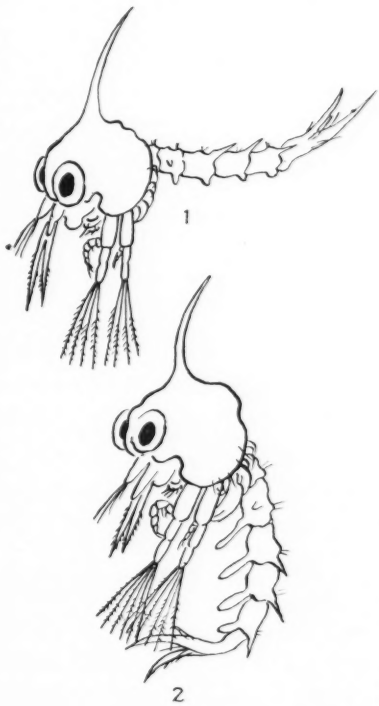


Fig. 2.
THE FIRST LARVAL STAGE.
Freed from its skin, the *pre-zoea* becomes a *zoea* (1), in which form it passes through two stages of development. The knobs seen on the tail (1), grow in the second *zoea* (2) to fairly long appendages.

pierced and a certain amount of air being admitted. The chief advantage of this method is that the water keeps for a considerable time, and in some cases can remain for months without being changed.

Crabs, like nearly all their crustacean relatives, have planktonic larval stages, that is to say, they float in the sea and are at the mercy of waves, winds, and currents. For this reason they are usually adapted for keeping up near the surface, and are specially modified for such a life. There may be from three to six of these planktonic free-swimming larval stages in the crab before it becomes in form like the adult and takes to living on the bottom. As the larva grows it gets too big for its skin, which is mainly composed of chitin impregnated with lime, therefore at certain periods it slits the skin and emerges, leaving a perfect outer skeleton behind. So perfect is the casting that even the lining of the alimentary canal is shed, and also the covering of the gills. During the larval period each stage is somewhat unlike the last, some new feature always being added or some old part discarded as the crab grows.

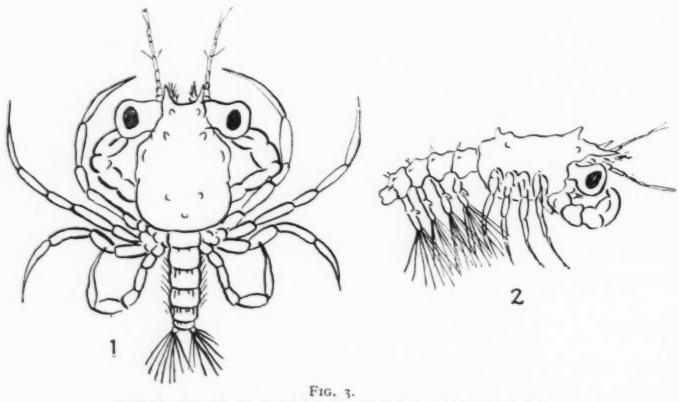


FIG. 3.
THIRD STAGE IN THE DEVELOPMENT OF THE CRAB.
These two views (1, dorsal; 2, side view) show that the *megalopa*, as the third stage is called, is quite unlike the *zoea* from which it develops. Though approaching the final crab in appearance, this form is still free-swimming, being flattened from above downwards (2), and not from side to side.

The eggs hatch out in the plunger jar, and are then transferred to a fresh one (both being inverted bell jars). Food must be provided, and this was at first a great difficulty, the natural food being minute living plants and animals floating in the sea. At last it was found the larval stages of mollusks, worms and echinoderms made good food, especially oyster larvae taken from the oyster just before it was ready to set them free. At this stage the little oysters are held in the gills of the parent, and already have a bivalve shell and can swim freely when liberated. When removed from the oyster they scatter themselves in the aquarium and are caught and eaten by the baby crabs. The young stages described below were reared entirely on these oyster larvae until the last larva, when small pieces of mussel were given. In the aquarium, however, were a good many minute green algae, and these apparently formed part of the food. The diet was thus a mixture of vegetable and animal, and on this the little crabs throve. Other batches of the same crab were brought through several of the larval stages on very young worm larvae and echinoderm larvae from artificial fertilizations, but none of these lived as far as the crab stage.

The eggs hatch in the form known as a pre-zoea (Fig. 1 : 1), which is really the first larval stage covered by an embryonic skin. This skin is exceedingly fragile and bears long hairy spines by means of which a wriggling movement is effected, mainly for the purpose of getting rid of this embryonic covering. In these long spines, however, many zoologists see interesting ancestral characters (Fig. 1 : 2, 3, 4). Having rid itself of this covering the first larval stage is freed. This is known as a *zoea*. There may be two to five zoeal stages. In the case of *Inachus Dorsettensis* there are two which are coloured a brilliant orange-yellow. A zoea has its body flattened from side to side, and swims by means of two pairs of limbs which later on change their function and become some of the mouth parts; for this reason they are called "foot jaws" or "maxillipedes." In the adult crab there are three pairs of these jaws, but the third pair in the zoeal stages is rudimentary, and so also are all the true legs. The maxillipedes of the zoea bear long stiff swimming hairs, known as "setae." There are four at the end of each in the first zoea and six in the second. The front part of the body is covered with a shield or "carapace," and this typically bears four long spines, one sticking up on the back, and called the "dorsal spine," one pointing downwards in front of the eyes, and a short one on each side of the body. In this spider crab, however, only the dorsal spine is present, but this is made up for by exceptionally long feelers with two spiny processes. There is also a short pair of feelers in front of these, and behind are large compound eyes composed of many lenses. Then come three pairs of powerful jaws, and behind the two maxillipedes are the rudimentary third pair and the rudimentary legs. Behind the carapace is the jointed tail ending in a fork and bearing

rudimentary appendages which are mere knobs in the first zoea and fairly long processes in the second. The tail also helps in swimming, and some of the segments have long spines pointing backwards. (see Fig. 2 : 1, 2).

Now the presence of all these spines and setae which project from the body of the zoea are all for a special purpose, and that is for keeping the body in the upper layers of water where food is to be found. These little larval crabs are thus admirably fitted for this end, the long spines of the carapace and feelers directing the movement, the setae of the maxillipedes spreading out like a fan and beating the water, the tail moving towards the water and out again. The first zoea measures rather less than a millimetre in length, the second is slightly larger with the rudimentary limbs more pronounced. The second zoea, which in this case is the last, now changes into another larval form which is quite unlike a zoea. This is called the "megalopa," meaning "large eyes" (Fig. 3 : 1, 2), and is much more like a crab, having all its legs functional, but is still free-swimming, and instead of being flattened from side to side it is flattened from above downwards. Its maxillipedes are now jaws and no longer swimming organs, having lost their long setae and being greatly altered in shape, and the limbs of the tail armed with long spines have taken on the swimming function, the tail itself being stretched straight out behind. These megalopae were fed on pieces of mussel, but they would on occasion eat one another. Finally the little crab emerged from the megalopa and this was a true spider crab, no longer free-swimming, with its tail tucked under the body and just like a miniature adult (Fig. 4 : 1, 2). As soon as this little crab came out of its megalopal skin it began to dress up, so strong was its instinct for disguise, and very soon it was so hidden by small pieces of debris and empty shells of the larval oyster that it was extremely difficult to see and most successfully camouflaged. It was a delightful sight to watch this baby, not a quarter of an inch across, carefully picking up these miscellaneous objects with its large nippers and placing them on the curved spines which cover the body. This little crab is still alive and has cast its skin three times. It is hoped that it may live and grow into an adult crab. The life-history of any crab is similar, and shows well the difference between the early planktonic larval stages and the bottom living adult.

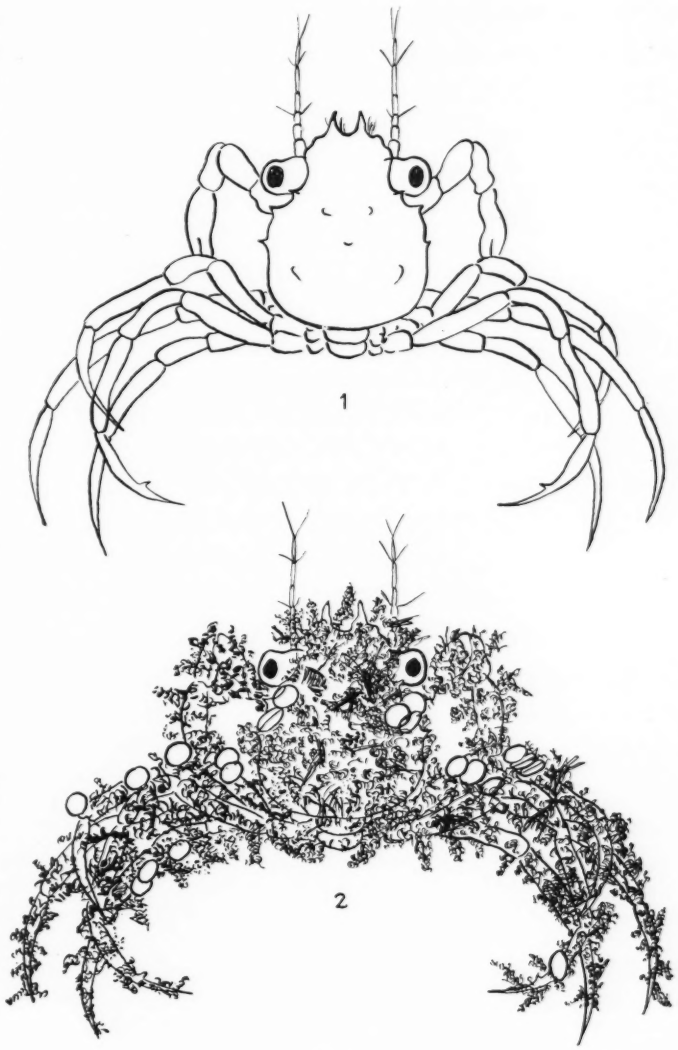


FIG. 4.
THE YOUNG SPIDER CRAB, SEEN BELOW "DRESSED UP" IN WEED.
The little crab emerges from the *megalopa* no longer free-swimming, with tail tucked under the body (1). So strong is the instinct for disguise, that it at once covers itself with small pieces of weed, shells, etc. (2). The hairs and spines on the body are not shown in these sketches.

As the rearing of this crab in the laboratory has been successful, several more are now being brought through all their larval stages.

A Visit to the Ruins of Palmyra.

By E. S. Forster, M.A., F.S.A.

Professor of Greek in the University of Sheffield.

Describing Palmyra, the Imperial city of the Syrian desert, the author suggests that unless measures are immediately taken, much may be lost to our knowledge of ruins which have never been systematically excavated. Modern guide-books still print a plan made by an English explorer nearly two centuries ago.

THE ancient city of Palmyra or, to use the native name, Tadmor, lies in the midst of the desert almost exactly half way between the Syrian coast and the Euphrates, thus forming a natural link between the Mediterranean and the Middle East. It owes its fame, first, to its romantic situation and the vast extent of its ruins, and, secondly, to the importance which, for a brief space, it assumed in the history of the ancient world. It is among the most extraordinary facts of history that, under its Queen Zenobia, Palmyra, an isolated city in the heart of the desert, became the capital of a vast empire, which extended from the Dardanelles to the Persian Gulf, and from the Caucasus to the southern bounds of Egypt.

Conquest by the Romans.

The first mention of Palmyra is in an inscription of Tiglath Pilezer I, about 1100 B.C. During the last millennium B.C. its importance must have been merely local, as a halting-place for caravans from the East. It was not until the Romans established themselves in Syria and began to harbour designs of conquest still further east, that Palmyra began to acquire a military and political, as well as a commercial, importance.

In 41 B.C. the city was rich enough to tempt the covetness of Mark Antony, who made an unsuccessful raid upon it. In the first century A.D. it became definitely a tributary of the Roman Empire, but enjoyed a semi-independent position with special privileges, which included the official recognition of the local Aramaic language. The civic organization was of the usual pattern of a Greek municipality of the Roman Empire, but a head man was appointed by Rome and granted senatorial rank. This position eventually became hereditary in a single family, the head of which for at least two generations bore the name of Odenathus.

To the Romans Palmyra was useful as a base of operations against the Parthians, and as a rallying-point for the nomadic Arab tribes who served as Roman mercenaries. It was visited by that indefatigable globe-trotter the Emperor Hadrian, in whose honour elaborate games were celebrated.

In the middle of the third century A.D. events in the East suddenly brought Palmyra into the full limelight of history. The Emperor Decius fell fighting against the Goths, and the eastern half of the Empire was for the moment left unprotected. His successor was defeated and taken prisoner by the Persians. At this juncture Odenathus, ruler of Palmyra, boldly came forward as champion of the Roman power, and defeated not only the Persians, but also the Goths who had invaded Asia Minor. He was rewarded by the Emperor Gallienus with the title of Imperator and recognition as joint-ruler of the East. But he was not destined to enjoy these honours for long, falling a victim in A.D. 267 to a conspiracy headed by his own nephew.

On the death of Odenathus, his wife Zenobia proclaimed herself queen in partnership with her son Vaballathus. Few women have played a greater part in history. Of striking beauty and wide culture—she was acquainted with Latin and Egyptian as well as Aramaic and Greek, and was authoress of a work on oriental history—she was also a warrior and accompanied her armies on campaign. She inaugurated her reign by a successful invasion of Egypt.

In A.D. 270 Aurelian became Roman Emperor, and was obliged for the moment to recognize Zenobia as joint-ruler of the East ; but it was obvious that, when once affairs were settled in the western half of the Empire, he would no longer tolerate the pretensions of the Palmyrene dynasty.

The End Approaches.

The struggle began in A.D. 271. Zenobia took the initiative and marched into western Asia Minor, withdrawing troops from Egypt, which was soon re-occupied by the Romans. Aurelian met her with a vast army and gradually pushed back her forces until he recaptured Antioch. The final battle took place at Emesa (Homs) on the edge of the Syrian desert between Palmyra and the coast. At first Zenobia seemed to be winning the day, and the Roman cavalry was routed, but the heavy weight of the legionaries finally prevailed, and the Palmyrenes fled across the desert to their capital, which fell

FIG. 1.
THE TRIUMPHAL ARCH AT PALMYRA.
On either side of the great arch, which was richly decorated with marble panels, are seen the entrances to the covered galleries for pedestrians. Here, viewed from the east, the Temple of Baal-Samin is also visible through the columns.

after a prolonged siege. Zenobia escaped, but was captured just as she was embarking on a vessel which was to carry her down the Euphrates. She was forced to march in golden chains in the triumphal procession at Rome, but was afterwards allowed to live in retirement on an estate in the Roman Campagna. Palmyra itself was generously treated, though it was placed under a Roman governor, but soon after Aurelian's departure the citizens rose against their masters. This time the Romans had no pity, and a wholesale massacre so reduced the population that much of the territory of the oasis passed out of cultivation, and Palmyra, from being the capital of an Empire, relapsed into its former condition of a desert city—a mere link between more important regions. It saw a slight recovery, however, in the reign of Diocletian and again in that of Justinian, under both of whom there was some building activity; but its glory was gone for ever.

To its isolated position and its unimportance must be attributed the preservation of the remarkable remains which have made Palmyra famous ever since its rediscovery by some English merchants from Aleppo at the end of the seventeenth century. Owing to political conditions the site has been so seldom visited that the most recent guide-books still print the plan made by the English traveller Robert Wood, who visited the site in 1751 and published a sumptuously illustrated account of it. At the present day the journey across the desert can be easily accomplished by motor-car, but, when the present writer made the journey recently, the French authorities were still finding it necessary to patrol the route with armoured cars and aeroplanes and to maintain a garrison at Palmyra, owing to unrest among the desert tribes.

The site of Palmyra (Fig. 4, plan), is protected on the west by a range of barren hills, the highest point of which is crowned by a mediaeval Arab castle (plan, 34), and through which a pass leads from the south-west. The greater part of the site has remained unoccupied. Part of the modern village, however, completely fills the vast court of the Temple of the Sun (plan, 1), the rest lying to the east and south-east of the ruins, where, thanks to the plentiful supply of water, there are considerable patches under cultivation. Three lines of fortifications can be traced, corresponding to three different epochs in the city's history. The outermost of these marks the greatest extension under Zenobia and is about two and a quarter miles in diameter. The second line, enclosing about half as much space as the

FIG. 2.
PART OF THE GREAT COLONNADE.
This structure traversed the city of Palmyra from east to west. An arch, where it was crossed by another roadway, is in the centre of the section shown above.

FIG. 3.
THE FUNERARY TEMPLE AND ARAB CASTLE.
The portico of the temple is seen in the centre distance. Part of the great colonnade is on the left of the photograph, the columns on the right belonging to ruins of private houses. The ancient Arab castle on the hill overlooks the desolate city.

first, probably dates from the time of Diocletian. A still smaller circuit (partly visible on the plan), seems to belong to the age of Justinian. This last enclosure contains all the important remains.

The site has never been systematically explored, and practically all our knowledge is derived from the remains still above ground.

The most striking ruins are those of the Temple of the Sun and of the Great Colonnade. The Temple (Fig. 5, and plan, 1) lies in the south-west corner of the city. It stood in the centre of a huge court (C) about 700 feet square, surrounded by a wall 50 feet high adorned with windows and pilasters. Round the inner side of the quadrangle thus formed was a colonnade of about 400 columns, many of which are still standing. The main entrance, which was in the middle of the west side, has been blocked up by the erection of a mediaeval Arab tower (B). The temple itself (A), which stood in the centre of the court, has a Corinthian colonnade, but the half-columns built into the wall of the *cella* are of the Ionic order. Since Wood's visit the temple has been converted into a mosque and the details of its architecture somewhat obscured. The whole of the court is now crowded with the squalid mud-huts of the modern village, which make it difficult to realize the spaciousness and dignity which must have characterized this vast structure. The outer walls of the court, though still to a large extent intact, have suffered somewhat since Wood's visit.

The Great Colonnade, which traverses the city from east to west, falls into three sections. The first, which has almost entirely disappeared, ran at an angle from the front of the Temple of the Sun to the Triumphal Arch (Fig. 5, H; Fig. 1), the side arches of which are orientated so as to face the temple. The whole surface of the arch was covered with marble and richly decorated panels with floral designs, many of which were still in position at the time of Wood's visit, but which have now nearly all disappeared. The structure itself has suffered little in the past hundred and seventy-five years, except in one important particular, namely, that the two central blocks of the great arch have dropped several inches and threaten to fall. It is a matter of urgent importance that something should be done if the arch is to remain intact. The second section of the Colonnade (plan, 5 to 10) runs from the Triumphal Arch to the remains of a quadruple arch known as the Tetrapylon. A portion of the Colonnade adjoining the Triumphal Arch is excellently preserved (Fig. 1). We may note the brackets which supported statues of distinguished citizens, whose virtues are recorded in Greek and Aramaic inscriptions. At each side of the roadway, which is about eleven yards wide, were covered galleries for foot passengers, no doubt lined with shops. The columns, which are all of the Corinthian order, are 27 feet in height and 3 feet in diameter; they are often worn round the bases from the continual action of the sand blown against them. Another fine stretch of the colonnade (Fig. 2) contains an archway marking a point where another road crossed at right angles. It is curious that only in a few places are there columns standing on both sides of the road. The custom of colonnading one

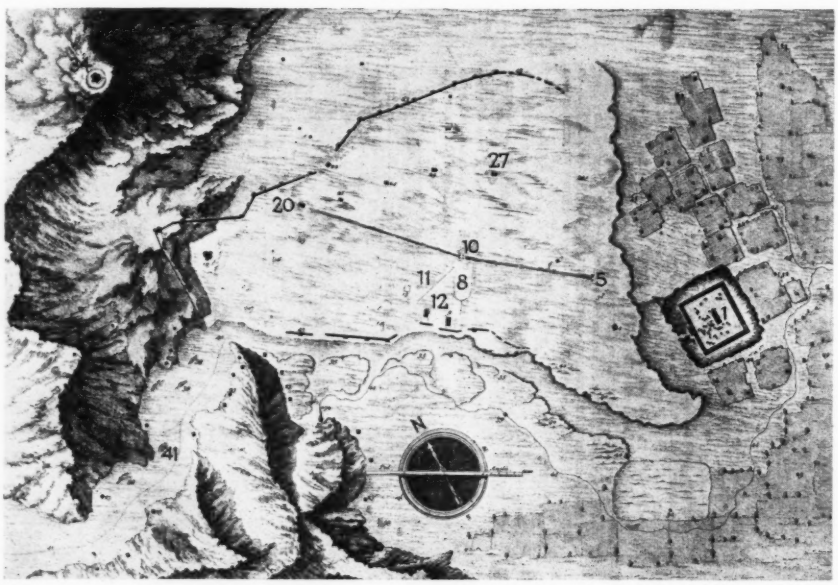


FIG. 4.

PLAN OF THE PALMYRA RUINS PUBLISHED BY ROBERT WOOD IN 1753.

The numerals indicating the various ruins with which Professor Forster deals, have, for clearness sake, been enlarged otherwise the plan is exactly as published by the English explorer nearly two centuries ago. (Plan from "The Ruins of Palmyra," R. Wood. London: 1753.)

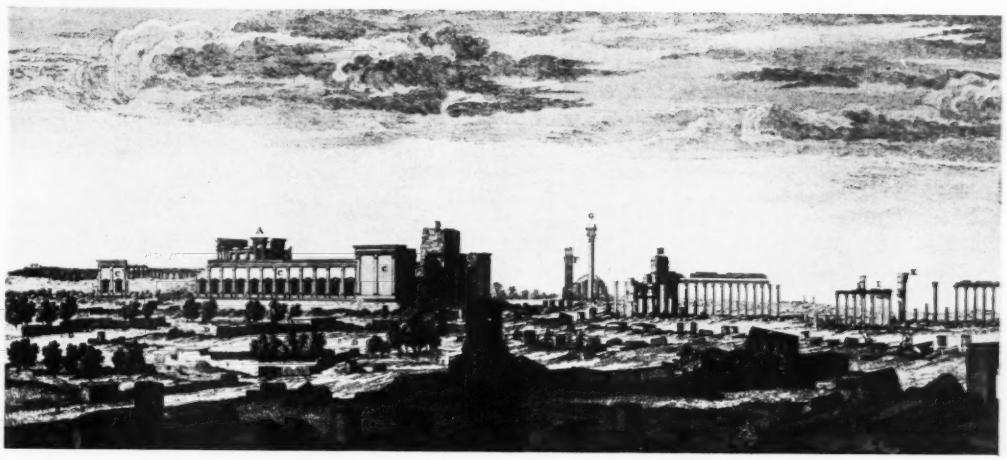


FIG. 5.

THE TEMPLE OF THE SUN AND OTHER RUINS AT PALMYRA, AS DRAWN BY WOOD.

The temple (A) stands in the centre of a huge court (C), the main entrance being blocked by the erection of a mediaeval Arab tower (B). Part of the great colonnade is seen to the right, with the triumphal arch (H) orientated so as to face the temple. (Plate from "The Ruins of Palmyra," 1753.)

or more principal streets is a feature of most ancient Syrian and Palestinian towns, and is said to have been imitated from Antioch. Roman Jerusalem certainly possessed such a colonnade, which is clearly represented on the interesting mosaic map of Palestine discovered at Madeba in Transjordania.

The third section of the Colonnade, from the Tetrapylon to the Funerary Temple (plan, 10 to 20; Fig. 3), is less well preserved, though some columns are *in situ* on both sides. On the whole length of the Colonnade, which is about 1,200 yards, there are about 150 columns still standing. Of the Funerary Temple little more than the portico of six columns is still standing. Wood was able to make a plan of the building, which consisted of a large hall with recesses for tombs. The decoration of the exterior was exceedingly rich.

Of the other buildings still standing the most interesting is the well-preserved Temple of Baal-Samin (plan, 27; also visible through the columns in Fig. 1). It is 60 feet by 30 feet in area, and has a portico of six Corinthian columns.

South of the central point of the Great Colonnade is a fine series of columns (plan, 8) enclosing an area which is semi-circular at one end and is the site of the theatre. Near it are the remains of a large building (plan, 12), which is believed to be the *agora* or market-place. Near it also is a fine row of columns (plan, 11), which bordered a street crossing the Great Colonnade at an angle at the Tetrapylon.

Recent research by the French Professor Gabrielle has made it clear that the western half of the city was the residential area, occupied by houses and divided into blocks on a regular system of town-planning. Several streets can be traced crossing the Great Colonnade at right angles, and the plans of two Christian churches and a Jewish synagogue have been identified, dating from the last period of the ancient city, *viz.*, the fifth and sixth centuries. Many of the houses had spacious central courts, of some of which the columns are still standing (Fig. 3).

A striking feature of Palmyra is the immense number of tombs still standing outside the city, especially along the road leading in from the south-west (plan, 41). Many of them take the form of towers, often five stories high, each consisting of a central chamber surrounded by recesses for coffins. Though stripped of most of their decoration, many of the tombs still possess finely sculptured ceilings.

It is impossible in a short survey to do justice to the richness and variety of such a site as Palmyra. A comparison of the condition of the ruins at the present day with their state as depicted in Wood's magnificent engravings shows considerable deterioration, even if some allowance is made for artistic exaggeration. It is hardly likely that the Temple Court will even be cleared of modern buildings, as has been done with such striking results at the great sister temple at Baalbec. Palmyra is too far from the beaten track to become a regular place of tourist-resort like Baalbec, which lies within an easy motor run from Beirut and Damascus; but measures should certainly be taken to prevent further dilapidation, in particular by repairing the great arch. A systematic excavation, if it is ever carried out, will yield a very rich harvest.

Further Thoughts on Bird-Migration.

By Commander B. Acworth, R.N.

Continuing a criticism of accepted views on bird-migration, the author prefaces it with some remarks on Professor Patten's "rejoinder" published also in our September issue. This article was, however, mainly written previously, and develops the subject further in the light of the physical factors affecting flight.

In his previous article the writer enunciated to the best of his ability what he has styled, for lack of a better title, the "Law of Currents." He has, in fact, applied to the flight and migration of birds a quantitative law which qualifies, where it does not invalidate, the qualitative assumptions of Professor Patten. In his interesting and courteous reply the Professor confines himself mainly to a repetition of certain evolutionary theories which he very clearly holds with an almost passionate devotion, but he is restless and ill-at-ease in replying to the specific points which the writer has made. Horror is expressed at my "degraded sublimation of bird-flight and mentality," but this horror must surely be confined to those modern biologists who seriously believe that human mentality differs only in degree, not in kind, from avian mentality, much as the mind of Shakespeare differs from that of a two-year-old child.

Professor Patten states:—"In no department of biological study is the evolutionary factor brought out more strongly than in bird movements." This very definite and important statement seems to an open mind to make it necessary to ensure that a fundamental law of flight, seemingly new to my critic, is in harmony with his theories and not at variance with them.

Laws and Theories.

I might well reply, with all kindness and good humour, that if I "stampede" at the modern biological *theory* that the mind of my child does not differ in kind from that of a chaffinch, Professor Patten becomes as restless as a swallow before migration at the forbidden word *law*. While raising no objection to the evolutionary "laws" which are, after all, largely speculative, and incapable of proof, he half-heartedly denies the "Law of Currents" which, if correct, is quantitative, admitting of no exception and therefore, where applicable, as safe a spring-board for "generalization" as is the first "Law of Motion." Nor does Professor Patten defend the quotations from his own words or specifically answer the writer's comments on them. Instead, if I may say so, he talks rather loosely about "mastery on the wing," and while seeming to admit that the Law of Currents is unbending—which indeed it must be if it is a law—claims exemption on behalf of the birds, so rightly dear to his *heart*.

Recognition, one of the sheet anchors of biological theories, is dealt with very briefly in subsequent paragraphs, as also is the extraordinary variation of movements in birds of the same species. The writer has no intention of pushing the Law of Currents into aspects of bird life to which it is not obviously relevant, and he has therefore confined himself to the movements of birds on the wing.

Before passing from Professor Patten's rejoinder to the remainder of this article, written before the rejoinder was seen, and since very slightly amended, it should be noted that he is now inclined to "pooh-pooh" the theory of the directive power contained in birds, a theory which is not only in conformity with commonsense and reason, and a matter of daily observation and remark, but which has had, hitherto, the great weight of scientific and ornithological opinion to buttress it. There is no need, however, to confound this directive power with human memory. Such a power is indeed the negation of memory and a mechanical substitute for an attribute of reason.

In my former article it was assumed, and this is the only assumption made, that birds have an automatic power of "sensing" the position of a given spot in space, which is not visible to the physical eye. It was shown that a bird, heading continually for a given spot and flying in an air-current, must inevitably reach its destination exactly head to wind. Furthermore, if the speed of the bird's own flight and the point for which it is heading is known, and if the mean direction and speed of the wind on the day or days of the Odyssey are ascertained, the bird's route can be exactly foretold. Due consideration of these simple aspects of dynamics at once exposes to damaging criticism those theories of migration which rest upon understanding, recognition, inherited memory, and such-like attributes in birds, and for the following reasons. The favourable winds which carry the birds to their destination vary from time to time in their force and direction, markedly so in northern latitudes, and to some extent, though to a much smaller extent, in southerly latitudes where

the trades and monsoons prevail. It is plain, therefore, that birds never *exactly* retrace their former route, though in the near vicinity of the final point of arrival or departure, or of a resting place en route, they progressively and retrogressively pass near to spots over which they have previously flown, or on which they have formerly alighted for rest and food. This being so, it is impossible for birds to fly by recognition, and we can account very simply for the fact (emphasized by Professor Patten) that "fly-lines vary in a most striking manner." In a long flight to the south, a variation of speed in the air-current of a single mile an hour, or a change of one degree in the mean direction of the air-current relative to the direct course to the final, or even intermediate destination, will ensure a divergence of many miles from a former landmark over which the bird flew in only very slightly differing weather conditions.

As already admitted, the writer does not claim an elaborate or specialized knowledge of birds. Some pains, however, have been taken to elicit from keen and competent ornithologists curiosities and phenomena in bird-life which are regarded either as mysteries or extraordinary exceptions to a general rule, and to these accurate observers he is indebted for the knowledge he has acquired. In these discussions, however, it has seemed to him that mysteries have been woven by the almost universal tendency to endow birds with thought and memory, an inevitable tendency if an unchanging law of dynamics is overlooked or unknown. It may be of interest to readers of *Discovery* to take a few examples to illustrate the points which the writer is endeavouring to make.

Family Flights.

It has been frequently noted that in certain species the male birds arrive some hours, and sometimes a day or more, before the females, and an atmosphere of romance and gallantry is elaborately wrapped round this phenomenon. It seems abundantly clear, however, that if the male bird is the fraction of an ounce heavier than the female—or its wing-spread a shade greater—its speed of flight must be a shade in excess of that of the female, otherwise the bird would "stall," to use flying parlance. Thus in all such cases the males *must* arrive in advance of the females, the extent of the interval being exactly conditioned by the speed and direction of the air-current in which the birds are flying, by the bird's own speed of flight, and the distance of the voyage. Hence the variableness of the interval. If these factors are known, the interval can be exactly calculated. If, on the other hand, the exact interval is observed, the speed and direction of the air-current known, and the locality from which the birds have come can be ascertained, the comparative flying powers of the sexes can be gauged.

The writer has recently read accounts of local migrations in which whole flocks of birds of a particular species are found to pass from one county in England to another, sometimes out of the country altogether, while others remain stationary. Various theories have been put forward to account for this curiosity, the most popular view attributing to the birds a dissatisfaction with the local food supply and a conviction that the food or conditions they crave for are to be found in another district.

A Moving Medium.

Surely a complete grasp of the Law of Currents will again come to the rescue. If certain birds of a particular species, or of various species, are living largely in open and exposed spaces they will from time to time experience, without actually feeling or knowing it, that the medium in which their movements take place is itself on the move, and at a speed which renders it a heavy exertion to maintain themselves in their immediate locality. If the medium is moving actually more rapidly than their capacity for flight *through* the medium, they will automatically pass away with the atmosphere to a new locality where the movements of the medium are slight enough to enable them to move locally from point to point without undue exertion. It is noteworthy that a breeze of 20 m.p.h. to a bird whose speed of flight is 30 m.p.h., renders the exertion of maintaining itself in a given locality three times as great as in calm air. When the wind reaches a speed of 30 m.p.h., the bird cannot maintain itself at all, if once it leaves its haven, whatever the haven may be. In sheltered gardens or woods these currents are, of course, not operative, and birds can maintain themselves in such a locality so long as they remain in the shelter it affords.

A detached consideration of the food supply theory at once reveals its vulnerability, not only because it predicates knowledge, decision, memory, and applied experience on the part of the bird, but equally, if not more so, because it is absurd to suppose that the tiny food supply necessary has failed in Staffordshire but become adequate in Sussex. A series of articles has been appearing anonymously in the *Times* and, so far as it is possible to judge, by the same pen. In his previous article the writer remarked that this correspondent was quite clearly unacquainted with the simple Law of Currents, and he cited this ornithologist's assertion that birds disliked flying with

the wind behind them as it would bend their feathers backwards. On this all-important subject it may be well to quote his opening paragraph in an article which appeared in the *Times* of 27th March, entitled, "Birds in Rough Weather: Discomfort and Danger":—

"Though birds have the mastery of the air, they dislike strong winds; and this is comprehensible from the structure of their plumage. Their feathers slope backwards, so that they must face the wind to escape not merely the discomfort of rumpled plumage but a positive danger. Birds' flight-feathers are elaborately hooked together, so as to allow them to strike the air as one flexible vane. A violent gust from behind must sometimes be strong enough to tear web from web, and make the bird an almost flightless cripple. Add to this the sharp wrench at the root of the quill which such a buffet would give, and we need not wonder why we see most birds shirking conflict with a gale, or at their skill in hiding in rough weather."

Here speaks the anatomical specialist, and here is revealed the ever-present danger of extremely specialized observation and reflection, no matter how accurate. From mere anatomical structure the author of this paragraph makes broad and sweeping deductions about the habits of birds which, to put it very soberly, are misleading. This ornithologist repeats Professor Patten's error when he says in another place in the same article:—"they too are careful to face the wind *either on the wing* or at rest." It is true that birds "dislike" wind, but their "dislike" is for reasons quite other than those advanced in this tell-tale article.

In view of the curious ignorance of the law of currents which this article betrays, it is not surprising that the explanation of the arrival of rare Arctic birds in Scotland during an exceptionally hard winter is quaintly misleading. The explanation advanced in another ornithological article in the *Times* was again a conscious quest for food on the part of snowy owls and other birds, the idea being that the Arctic regions were so exceptionally inhospitable that birds deliberately forsook those bitter regions for the comparative friendliness of the Scottish climate, about the nature and properties of which they are presumed to speculate.

Atmospheric Drift.

But what causes an exceptionally hard winter in Scotland? The steady and continual drift of the Arctic atmosphere to Scotland (the north wind), a drift which perhaps becomes slow and almost imperceptible in Scotland, but which is rapid and continuous in Arctic regions and of such a nature as to cause comparatively weak-flying birds to pass away in their drifting medium when the exertion of maintaining themselves becomes over-great or over-protracted. This ornithologist presumed an exceptionally bitter winter in the Arctic, an assumption in no way legitimate. In any case a few extra degrees of frost in regions where cold is reckoned in tens of degrees below Zero is hardly likely to be noticeable or unduly troublesome to Arctic birds. In reading recently a work on birds, the writer was struck by a reference to the Cape Verde Islands, where, it was stated, examples had occurred of the presence of North European birds. The writer has not the book beside him for reference, but the question arose in the enunciating of the evolutionary "Law of Dispersal."

Victims of the Weather.

It was noted in the discussion that these stray birds always become indigenous, and considerable mystery was said to surround these unusual events. There is in reality no mystery. These birds, probably with thousands of others which were drowned in the Atlantic, passed under unusual weather conditions into the North-east Trade Wind, and were borne along in the great, silent, and pressureless stream to the south-west, the lucky ones being swept over the Cape Verde Islands. They became indigenous for the same reason that Senor Franco and other famous airmen would have become indigenous, had these *human* "birds" not *elected* to pass on to South America in the mighty atmospheric south-western stream.

As with Senor Franco and the rare visiting birds, so with Colonel Lindbergh and a rare specimen of American birds, a red-legged cuckoo, which within a few days of one another crossed the Atlantic from east to west. Both were rare "birds"; neither returned by air, and both were one way migrants, since westerly winds prevail in the North Atlantic. It is believed that very rare cases have been noted of European birds being observed in North America.

Such a rare occurrence undoubtedly coincided with an unusual and protracted drift of the atmosphere at high speed from east to west, a drift for which our human "birds" have been waiting in vain throughout this summer. It can be hazarded with confidence that no *South* American bird has ever been found in Europe owing to the unchanging barrier of the North-east Trade current. As with North and South Atlantic visiting airmen or birds, so with European airmen, and, for all the writer knows, birds. A rare few pass far away to the east, their odysseys being attempted and timed, in the case of airmen, to suit the great monsoons, and with an east-going stream at the commencement of the flight.

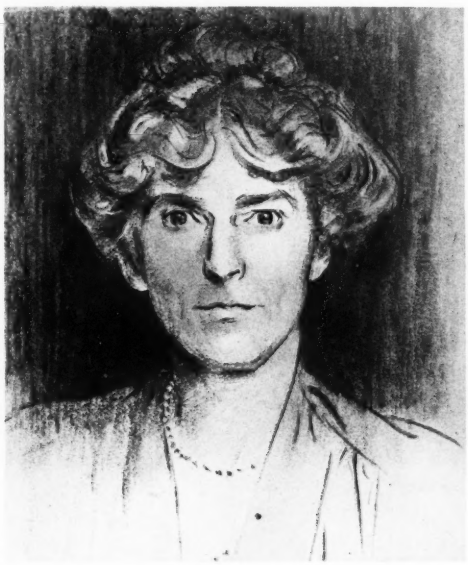
"The Letters of Gertrude Bell."

A Review by E. N. Fallaize.

Honorary Secretary, Royal Antropological Institute.

The newspaper notices of the newly-published "Letters" of the late Miss Gertrude Bell have centred interest on her remarkable diplomatic career in the Near East. Our reviewer discusses in particular her many achievements as traveller and archaeologist.

EACH race and each nationality prides itself on the character of its women, and finds in them the expression of some among the highest of its ideals—a fact which is susceptible of an obvious biological explanation. Without entering into any invidious comparison of the relative merits of national ideals in feminine excellences, we may perhaps be pardoned for holding the opinion that the English-speaking races, and especially those which include any considerable element derived from the Nordic strain, have produced a proportionately greater number of exceptional women, highly endowed with the qualities which make for the welfare and progress of humanity. Be that as it may, there can be no two opinions that Miss Gertrude Bell, the distinguished archaeologist and traveller, a selection of whose letters has just been published,* possessed in a pre-eminent degree those qualities upon which the English as a people most pride themselves, and by which they have contributed most generously to the advancement of civilization and the humanities.



GERTRUDE BELL.
From a portrait by John Sargent, R.A., in 1923.

Gertrude Margaret Lowthian Bell was born on the 14th July, 1868, at Washington Hall, Co. Durham, the residence of her grandfather, Isaac Lowthian Bell, F.R.S., afterwards Sir Lowthian Bell, Bart., ironmaster, colliery owner, and distinguished man of science. Gertrude's father, Sir Hugh Bell, was Sir Lowthian's eldest son. Her mother, Mary Shield, daughter of John Shield of Newcastle-on-Tyne, died at the birth of the second child of the marriage, Maurice, when Gertrude was three years old. When she was eight her father married the present Lady Bell, who edits this collection of letters and to whom many of them are addressed. By descent she was connected with both Northumberland and Cumberland, her immediate forbears were prominent in industry and learning alike, while her family connexions and social position brought her into intimate touch in her impressionable years with certain social and political circles in the later decades of the last century, when the colour of political opinion and social status had a greater formative influence than they have at the present day. These elements in her character may readily be discerned, and it is interesting to note in these letters how, as the years go by, those traits which may be traced to her birth and early environment still persist as her interests broadened and her knowledge and experience grew. The business instinct of the north country to obtain full value for expenditure, which she shows in her early letters to her stepmother when managing household affairs at Redcar, was fully as keen when in the last years of her life she was organizing the archaeological museum in Baghdad, her crowning work. Perhaps, too, something might be attributed to her northern upbringing as well as her ancestry in her ability to set aside all sentiment at need, and to weigh up a situation and determine her action entirely on what seemed to her its absolute merits. Time after time, especially in the later years, she had to decide between the call of sentiment and the claims of her work or her duty as she saw it.

**The Letters of Gertrude Bell.* In Two Volumes. Selected and edited by Lady Bell, D.B.E. (Ernest Benn Ltd. 42s. net the set).

Invariably the latter prevailed. Yet no one reading these letters would call her hard in any derogatory sense. A dominant note in her character throughout is her intense affection for her friends, and an almost passionate devotion to her father and stepmother. To the opinion and judgment of the former she was ready to defer to the end of her life, and the greatest joy of her later years was afforded by the visits her father paid her when she was stationed in Iraq, and when she flew to meet him at Jerusalem.

Vivid Impressions.

The letters in the present selection, with the exception of one or two written at an early age, begin in 1889 and extend to the time of her death in Mesopotamia on 12th July, 1926, the last being dated 7th July. They are addressed almost exclusively to her father and stepmother, and even of this correspondence they are only a part. An indefatigable writer, as the Editor says, she was always able to dash down on paper, however tired she might be at the end of a long day, her impressions, vivid descriptions interspersed with shrewd and penetrating judgment on things, events, and above all, people. Everything she wrote is of value, for some reason or other, but most of all as a manifestation of the writer's quality and humour. It is therefore with regret that periodically we come to an editorial note, that letters in whole and part are omitted because she describes routes and places already sufficiently familiar. But the reader will wish ardently to see them again through Miss Bell's eyes and to know what she thought of them. As an example of her penetrating yet just estimate of character we may quote the following description of the Smyrniote "Mediterranean Race," of which the fairness and accuracy will be admitted by all who know them.

"It speaks no language though it will chatter with you in half a dozen, it has no native land though it is related by marriage to all Europe, and with the citizens of each country it will talk to its compatriots and itself as 'we'; it centres round no capital and is loyal to no government, though it obeys many. Cheerful, careless, contented, hospitable to a fault, it may well be all, for it is divested of all natural responsibilities, it has little to guard and little to offer but a most liberal share in its own inconceivably hugger-mugger existence. Kindness is its distinctive quality, as far as I have sampled it, and I hope I may have many opportunities of sampling it further."

Many of these letters, especially those in the first volume which deal with her journeys in the Syrian desert and in Arabia, may be regarded as an instructive supplement to Miss Bell's books, particularly "The Desert and the Sown" and "Amurath to Amurath." Their more intimate character frequently admits us behind the scenes of incidents which she has described elsewhere. Conveniently enough, the division of the letters into two volumes almost coincides with the great break in Miss Bell's life which came with the war when her activities were diverted to lines, permanently as it turned out, which almost certainly would not have been in accord with her own desires had she been free to choose, yet in the event placed her in a position to perform her greatest service to archaeology. The first volume covers her early travels to Rumania and Persia when she stayed with family connexions at the Embassies, her experiences as a mountain climber, her more intimate introduction to archaeological studies, her journeys of exploration—archaeological and geographical—in the Syrian desert and Arabia, and her activities in the early days of the war when she lectured and nursed in England, and then went to France to the office for tracing the missing and wounded. As the volume closes, she had joined Dr. Hogarth in Cairo in order that her knowledge of the tribes of Northern Arabia might be made available to the Staff, had been to India to adjust administration difficulties as between Cairo and Delhi, and had proceeded to Basrah to join the Staff there, her duty being the compilation of a list of the Arab tribes—a work of incalculable value which was described later as a complete account of Iraq as it was at the time we took over.

Work in Iraq.

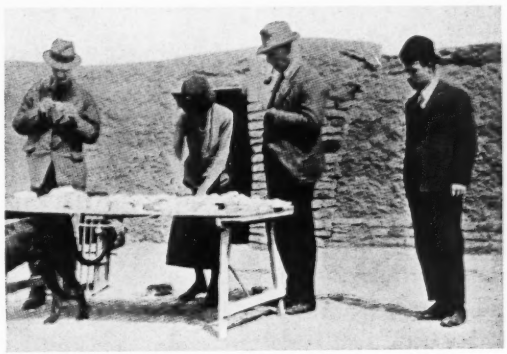
During the whole of the period covered by the second volume, which extends from 1917 to the time of her death in 1926, she was stationed in Iraq, where she was attached to the staff of Sir Percy Cox, Chief Political Officer and afterwards Civil Commissioner at Baghdad until he was transferred to Teheran. At first she was a "war worker," but the value of her services was recognized as so great that she was prevailed upon definitely to enter Government Service, holding the office of Oriental Secretary which she later combined with that of Director of Antiquities.

With so much material from which to choose even among the letters addressed to her parents, the Editor's task has not been easy. Among the earlier letters a few might be regarded as of slighter interest, if it were not for the light they throw on the gradual development of her character. It is amusing, for instance, to note how her attention to dress gradually increased as she developed—when first she went to Oxford it is said of her by one of her friends she was

"untidy." Yet in view of her later career, and notwithstanding the thrills of her Alpine experiences and the attractive pictures she draws of the people she met and the places she visited, the attention of the reader will undoubtedly tend to concentrate on those letters written when she was travelling in Syria and Arabia. These journeys might seem to have been taken as a preparation for the great work of her life, the truth being, of course, that when once Britain had taken up the line of action which has led to our present position in Mesopotamia and the formation of the Kingdom of Iraq, she was one of a small group of which Dr. Hogarth may be regarded as the leader and chief, who were marked down by their knowledge of the country, the conditions, and the people, as indispensable for intelligence work. Our relations with the Arab tribes involved the most delicate manipulation, in which her knowledge of the East and especially of the tribes of Northern Arabia had eminently fitted her to assist.

Her journey to Teheran, undertaken in her twenty-fourth year, had first brought her into contact with the literature and peoples of the East, for which her previous study of the language had already prepared her. After a voyage round the world with her brother, she visited Jerusalem in 1899, began to learn Arabic, and made her first desert journey, visiting Petra. She records eloquently the strong impression these wonderful ruins made on her. After several excursions in various directions, she penetrated to the Jebel Druzes, notwithstanding Turkish official opposition. This was the first of the many occasions on which she showed her determination in attaining her objective notwithstanding difficulties and opposition placed in her way by officials. In 1905, after a second voyage round the world, which included the Delhi Durbar of 1902, she was again in Syria among the Druzes, a journey which involved many a danger and stirring incident lightly passed over, as may be seen both here and in "The Desert and the Sown," in which she afterwards described her journey. In 1907 she was in Asia Minor working on the archaeology of the churches with Sir William Ramsay, with whom she collaborated in "The Thousand and One Churches," which contains the results of their joint investigations. In 1909 she accomplished what was perhaps her most valuable piece of purely archaeological work on the Castle of Ukhaidir, of which her account was published by the Oxford University Press in 1914. She had, it is, however, true, accomplished much valuable archaeological work in her previous journeys, in the collection of inscriptions, Hittite and other; but of this the real significance is hardly to be discerned here in letters written at the time before the inscriptions had been submitted to expert examination.

In 1913 she commenced what was to prove her last great journey in the East, her journey to Hayil, when she traversed the North Arabian desert, and acquired that knowledge of the land and the people which enabled her to compile her invaluable list of tribes—her first and in some ways her greatest contribution to the intelligence work of the staff in Mesopotamia. The story of her journey is told here almost from day to day in her letters. No more intimate and, at the same time, vivid yet unsensational picture of the incidents of desert travel could be desired, the alarms



SORTING OUT THE FINDS.
As Director of Antiquities, Miss Bell is here seen working at material for the archaeological museum in Baghdad.

MISS BELL'S AEROPLANE.
Sir Hugh Bell is standing (back to camera) by the machine, while Miss Bell climbs out. She flew with her father from Jerusalem to Baghdad.

of possibly hostile Arabs, the inconveniences and hardships through a scarcity of water, not unduly stressed yet given their full significance in their effect on the welfare or the reverse of the party. Dr. Hogarth and Mr. E. A. Reeves of the Royal Geographical Society bear witness to the value of the scientific results of this journey. Here, reading between the lines, we can discern the qualities which enabled her to achieve them and to perform a task which after report has made almost legendary in its incidents.

We must pass briefly over the later years. The exigencies of the censorship during the war has necessarily robbed her story of much that would have been interesting to a later generation. Yet the valuable sidelights on the course of events and on personalities are numerous. Necessarily Miss Bell was much concerned in the negotiations with the Arab tribes and the events which finally led up to the formation of the Kingdom of Iraq and the installation of King Faisal. Here, too, the later historian will find ample material when he comes to write the history of the formation of the Department of Antiquities in Iraq, and of the British excavations at Ur and Kish which have added so enormously to our knowledge of the early development of civilization in this part of the world. As Director of Antiquities Miss Bell was closely associated with this work, and here describes her constant visits to the excavations.

The Baghdad Museum.

But her great achievement was the formation of the museum at Baghdad, which now houses part of the material acquired by the excavations, at which she laboured assiduously, a labour which overtasked her strength and undoubtedly has ened her untimely end. At the suggestion of King Faisal one of the principal rooms in the Iraq Museum has been named the "Gertrude Bell Room," and her friends have erected in a prominent position a brass plaque with a suitable inscription. Of her, however, it can most truly be said *Exegit monumentum aere perennius.*

In reading through these letters the characteristic which is as marked as her affection for her family is her intense vitality and the avidity with which she seized upon every scrap of knowledge that came within her range, especially in connexion with the acquisition of languages. From the time of her earliest travels it was her practice when about to visit a new country to acquire as close an acquaintance as she could with its language and this to her was no labour but a joy. Arabic, however, tried her powers. She speaks of the "awful fun" of practising the partially acquired tongue on the natives. Even when she went to Persia in her early years and stayed at the Embassy at Teheran, she had already acquired a fairly intimate acquaintance with Persian which stood her in good stead when she came into contact with the people, and bore fruit in her translations of Hafiz, from which extracts are here quoted. Had her activities not been diverted into other channels, she might well have become a poet of some note.

A Full Life.

Her life was extraordinarily manysided, and there was nothing she touched in which she did not excel. As a student of Lady Margaret's Hall at Oxford she took one of the most brilliant of first classes in history; an accomplished linguist, she spoke many languages, Western and Oriental; an intrepid mountain climber —she describes in one of her letters a terrible experience on the Finsteraarhorn in a blizzard, to which none but the most hardened of men climbers would not have succumbed, when she was roped to her two guides for fifty-three hours continuously—an explorer whose survey work in Arabia added much precise information to our knowledge of both land and tribes of which full advantage was reaped during the war; and an archaeologist precise in description with a flair for the things to look for and the things worth finding, even when she had still to acquire full mastery of the subject of her investigation. But above all was her ability to consort in friendly companionship with the peoples of the East, which was equalled only by her coolness and determination on occasion in over-riding their opposition when they wished to intervene between her and the end she had set herself to attain. Reference was made at the time of her death to the difficulties of this nature, including her arrest, which she encountered on her last journey in Arabia before the war. These she describes vividly and with humour; but she also shows that she knew when to take a warning. In fact, her letters at this time read as if she might herself have been a member of a raiding party in a hostile country.

The many sides of her character come out clearly in the letters, for she wrote with a frankness and a lack of self-consciousness to which their intimate character gave free vent. Each one is written with a zest and spontaneity which, almost naive in self-revelation, never flags, even in the weariest days of the war and in the later period when, thoroughly overworked, she struggled against adverse climatic conditions in Mesopotamia. There is no word, no phrase, which does not exemplify the sterling qualities of her character.

A Review of the British Association Meeting.

(By Our Special Correspondent at Leeds.)

Following the forecast published last month before the meeting, we give below an account of some outstanding papers read to the British Association last month at Leeds. Our correspondent wishes to acknowledge special notes kindly supplied for "Discovery" by several of the lecturers.

THROUGH the presidential address, and the addresses to the various sections, the British Association meetings give us a useful opportunity of catching a glimpse of what the specialists regard as problems of importance. As these addresses are separately and collectively available in the printed form, it may be of some interest to classify them from the point of view of the non-specialist reader of this journal. His views on the subject would probably approximate to the following: Sir Arthur Keith's presidential address, being a scholarly and well-written statement on a subject in which everybody is interested, ought to be read by all. The addresses to the sections of geography, economics, engineering, anthropology, physiology, psychology, education and agriculture can be enjoyed by most general readers. Those to the sections of mathematics and physics, chemistry, geology, zoology and botany are more specialized, but many readers, according to their tastes, will get something out of one or other of them.

Darwin's Theory.

As regards the meeting itself, the council of the Association, by an unconscious stroke of genius, arranged that at Sir Arthur Keith's broadcast presidential address on "Darwin's Theory of Man's Descent as it Stands To-day," the chair should initially be occupied by a pioneer worker in the realm of wireless communication—Sir Oliver Lodge. Possibly the arrangement was not a coincidence, but an act of premeditation, in which case the present writer hastens to withdraw the word "unconscious" and to apologise profusely. A gentleman at the Press table was heard to remark grimly that one good thing about these broadcast addresses was that the speakers had to keep to time. If this tribute meets Sir Oliver Lodge's eye he will doubtless feel that he has not lived in vain.

While Sir Arthur Keith did not minimize the "difficulties and dangers which beset the task of unravelling man's ancestry," his statement of his view of the present position was not lacking in bluntness. "No structure found in the brain of an ape is lacking in the human brain, and, on the other hand, the human brain reveals no formation *of any sort* that is not present in the brain of the gorilla or chimpanzee. . . . No matter what line of evidence we select to follow—evidence gathered by anatomists, by embryologists, by physiologists, or by psychologists—we reach the conviction that Man's brain has been evolved from that of an anthropoid ape. . . . Was Darwin right when he said that Man, under the action of biological forces which can be observed and measured, has been raised from a place amongst anthropoid apes to that which he now occupies? The answer is Yes!"

The Hormones.

At the moment there is unusual significance in the reference made by Sir Arthur Keith to a recent explanation of some puzzles of evolution (such as "variations") which were unsolved in Darwin's day. Speaking of the activity of various glands in the body—the sex glands, the thyroid, etc.—he pointed out that "under the disorderly action of one or other of these glands individuals may, in the course of a few years, take on so changed an appearance that the differences between them and their fellows become as great as, or even greater than, those which separate one race of mankind from another." These changes are due to the activities of substances known as hormones, which, formed in the glands, give rise to remarkable effects on various other parts of the body which they reach through the blood. Reference is made to these substances here because "The Chemistry of the Hormones" formed a topic of discussion at a meeting of the chemistry section of the Association. So far, the only hormones which have been produced synthetically by chemical means in the laboratory are adrenalin (which occurs in the suprarenal gland, and has the property of raising the blood-pressure) and thyroxin. The latter is the more interesting at the moment, since its synthesis was effected only a short time ago by Barger and Harington, working in Great Britain. It is obtained from the thyroid gland, disturbances in which give rise to remarkable bodily and psychological symptoms. Excessive activity of the gland, accompanied by its increased growth, is the condition known as goitre; while it has been shown that removal of the gland from animals (thyroidectomy)

results, among other things, in a remarkable stunting of growth. At the chemistry section's discussion, Professor Barger announced that Dr. Harington had been able to proceed a step beyond the synthesis of thyroxin in the separation of the synthetic product into two substances identical in chemical composition but differing in the spacial arrangement of the atoms in the molecule. This point is related to the fact that often, where substances of this special type are found in the animal organism, only one of the two forms occurs; but further discussion of this would take us too far afield.

Another hormone, insulin, which occurs in the pancreas, a gland near the stomach, also received attention at the meeting. While extracts containing it have been used for the treatment of diabetes for some years past, it has not yet been isolated in the pure state, a step which is a necessary prelude to the determination of its chemical composition and structure, and its possible subsequent synthesis. Emphasis may be laid on the great difficulties which arise when attempts are made to produce pure insulin — difficulties which are of constant occurrence in the study of the hormones. Nevertheless, it is a hopeful sign that such considerable advances have already been made in our knowledge of substances of such importance to the working of the body; and a striking testimony to the unity of all science that research of a chemical nature may have echoes in a branch of study so apparently remote as evolution.

Heredity and Environment.

The respective claims of those battered old warriors, heredity and environment, in their influence on evolution, formed part of the theme of Professor Parson's address to the anthropology section on "The Englishman of the Future," in which he dealt with the height, eye and hair coloration, and head shape of the future inhabitants of this island. He put forward the view that the better hygiene and nutrition of the last fifty years or so had had an appreciable effect in increasing the stature of Englishmen and Englishwomen. The height of men has increased to an average of about 5 feet 9 inches, attained at least twenty years ago, in the middle and upper classes (Professor Parson's judged from measurements made during the last twenty years on his students at St. Thomas's Hospital); and in the address reasons were given for supposing that this was a maximum height, at any rate for the purest Nordic stock, to which the whole community would increase, rich and poor alike, thereafter not increasing.

For women, on the other hand, according to measurements made on nurses and others at St. Thomas's (belonging to the same class of the community as the male medical students), the average height is 5 feet 5 inches. This is still increasing, and, says Professor Parsons, will probably attain a maximum of 5 feet 6 or 7 inches. At this point the relative values of heredity and environment may be estimated: "In the present subject of stature we have seen environment, in the shape of wise feeding and a full supply of fresh air, increasing the male height to 5 feet 9 inches twenty years ago; but at that height the hereditary maximum of the Nordic race seems to have been reached, and since then no improvements in surroundings have been able to increase it. When I say that 5 feet 9 inches seems the hereditary average maximum of the Nordic race I do not mean that our Saxon forefathers were of that height; indeed I know that they only averaged 5 feet 6 inches. What I mean is that 5 feet 9 inches seems to be the highest possible score for Nordic peoples."

As regards coloration, Professor Parsons remarks that 66 per cent. of our population have light eyes and 34 per cent. dark, this state having become stationary; hair colour does not seem to have darkened in the last sixty years, but, on the contrary, may have become lighter. Finally, signs have been found of increase in the height of the head, with a proportional decrease in length. This is not "a harking back to any ancestral form, but must be regarded as an evolutionary process, in harmony with the greatly changed conditions of life which have come about during the last century. . . . Heredity alone will not account for the Englishman of the future."

'Woodhenge.'

Another paper which the anthropology section was privileged to hear was by Mrs. M. E. Cunnington on 'Woodhenge,' which, judging by the opinions expressed about it in the subsequent discussion, seems likely to assume first-class importance. An aeroplane pilot noticed curious colour-variations in crops growing at Durrington, Wiltshire, and a photograph taken from the air in 1926 revealed a series of pits, arranged in concentric ovals, within a circular ditch, and showing some similarity to aerial views of Stonehenge. Excavations carried out by Captain and Mrs. Cunnington showed that these pits (now filled with earth) once held the bases of timber posts or uprights. Scrape-marks where the uprights had been inserted into the pits were still visible, and were at once recognized as typical by timber-workers. In the centre of the site (which by analogy with Stonehenge

has been named Woodhenge) was found buried the skeleton of a child, the skull having apparently been cleft before burial. The site is a little less than two miles north-east of Stonehenge, comparison with which reveals various similarities between the two. In both the main axis of the structure is directed towards the rising sun at midsummer. The less skilful construction of Woodhenge, especially the use of timber instead of stone, indicates that it was the earlier of the two, and the evidence seems to suggest that it must be dated at the end of the Bronze Age, if not contemporary with the beginning of the Iron Age. Possibly the wooden structure was really an earlier prototype of Stonehenge, which was subsequently built in more permanent form.

The structure may have been designed for some sort of ceremonial or religious purpose. In spite of the grave in the centre, it is not thought to be merely a burial place; possibly the child was a dedicatory offering. The fact that the skull of the child was cleft before burial appears to rule out the possibility that it was a very important child to which the structure was erected as a memorial.

Air Exploration of the Poles.

Criticism of some aspects of exploration of the polar regions from the air was uttered by Dr. R. N. Rudmose Brown in his presidential address to the geography section on "Some Problems of Polar Geography." A rapid flight over snow-covered land, even if this could be distinguished from ice-covered sea, would not yield much important information. For reconnaissance work in polar regions the use of aeroplanes is of doubtful value owing to the difficulties of ground organization and of the provision of landing-places, while for purposes of transport the use of aeroplanes is heavily discounted by the element of uncertainty which they introduce into the work of an expedition. The comparative lack of success of aerial methods at present does not, however, mean that they will never be of value in polar exploration. Indeed, Dr. Rudmose Brown drew attention to the value of aerial methods of survey.

One passage of this address has, at the moment, such a direct bearing, not only on polar exploration but on other matters, that it deserves to be quoted: "It may be regrettable, but it is certainly true, at least in this country, that an expedition with purely scientific aims and no sensational journey or feat in its programme must appeal in vain for funds. These are seldom forthcoming for the advancement of pure knowledge. . . . It is unfortunate that in recent years more than one expedition has been successful in raising funds for programmes that were little else than spectacular and bore the smallest prospect of useful work. . . . Every serious worker in polar research must regret the entry into the field, from time to time, of men who have few qualifications for the task and see in it merely an opening for spectacular notoriety, or a measure of financial gain by means of dramatic cinematograph films or newspaper articles."

Dr. Brown made some very interesting remarks in regard to the food-production possibilities of the polar regions, further reference to which is prevented by lack of space.

Climates of the Past.

The discussion between botanists, geologists and physicists on the climates of past ages was opened by Professor A. C. Seward. Fossil plants have been used as thermometers of climatic conditions, it being generally assumed that the conditions under which existing plants grow may be accepted as criteria of past conditions. In the Arctic Circle there have been found fossil plants of types which at the present time grow in the tropics and sub-tropics. It has therefore been thought that in the past Arctic temperatures have been much higher than they are now. Professor Seward is of the opinion that these plants were originally much more resistant to climatic conditions than at present: they have, in fact, become "senile." Moreover, certain genera are known which, although mainly tropical in their distribution, are represented by certain species which flourish at high altitudes where conditions are much less genial. There is therefore no need to assume from the evidence of fossil plants that conditions in the Arctic in the past have differed greatly from those in the present. Past estimates of temperature on this basis may have been exaggerated, and we must modify our view of the use of fossil plants as a test of temperature.

Dr. G. C. Simpson discussed the matter from the physical point of view. Climates may change for three reasons: because of changes (1) in the distribution of land and sea; (2) in the composition of the earth's atmosphere; and (3) in solar radiation. The distribution of land and sea in the northern and southern hemispheres shows large differences; yet it is found that the mean temperatures of corresponding latitudes in the northern and southern hemisphere differ nowhere by more than 3° Centigrade, while in most cases the difference is less than 2°. The first factor considered above therefore has little effect. As regards changes in the composition of the earth's

atmosphere, the most important constituent would seem to be volcanic dust, relatively small amounts of which, it has been calculated, can produce a material reduction in the effective solar radiation. If geologists can show that abnormal volcanic activity accompanied each of the great ice ages, then here is a possible explanation of the necessary reduction of temperature. Finally, there is the question of possible variations in the amount of solar radiation received by the earth, there being two alternatives: (*a*) Actual changes in the amount of energy radiated by the sun; and (*b*) Changes in the relative positions of the sun and the earth. Calculations have shown that at a station situated in latitude 65° the solar radiation received during the summer half-year undergoes changes due to the changes in the earth's orbit which are equivalent to a shift of latitude of 15°. This factor will certainly have to be taken into account in future discussions.

Professor J. W. Gregory indicated that the fossils of marine fauna found in Greenland showed that in the past the conditions there had been Arctic or sub-Arctic.

The Great Barrier Reef Expedition.

With regard to the 1928 Great Barrier Reef Expedition, which was discussed by the zoology section, Mr. F. A. Potts, who will lead the expedition, and will contribute an account of it to *Discovery*, summarized the arrangements as follows: The proposed Barrier Reef Expedition is of a different type from expeditions of the past in the following respects. First of all, a narrow sector of the Barrier Reef will be examined, and the examination will be of a thoroughness that has not been possible before. Then, not merely will the life zones of the reef be thoroughly examined by a shore party (based on the Low Islands near Cairns, Queensland), but the various biological and physico-chemical conditions which bring about the constitution of the reef will be analysed as carefully as possible. While this has been done to a certain extent in the recent expedition of the Carnegie Institute of Washington, this expedition will break new ground in a thorough examination of the inshore and offshore plankton, and so an important part of the work of the expedition will be performed by a boat party. The boat will be at least forty feet in length, and fitted with the most trustworthy engines, to keep the sea in all weathers; its complement will include a chemist who will make the requisite observations on the physics and chemistry of the sea-water, as well as two biologists who will respectively investigate the animal and vegetable parts of its floating life. They will make observations at certain fixed stations for twenty-four hour periods, and these observations will be carried out over a period of a year at least. Such thorough investigations cannot fail to be of great importance, for tropical plankton is a subject of which practically nothing is known.

The meeting at which the matter was discussed was also addressed by Sir Matthew Nathan, Sir T. W. Edgeworth David, and Dr. C. M. Yonge, and gave its warm approval to the suggestion that the committee formed in this country to deal with the matter (consisting mainly of leading zoologists, to which had been added representatives of geographical, geological and other interests) should be replaced by one appointed by the British Association for the general purpose of studying the coral reefs.

Cosmic Rays.

It will be remembered that some little time ago accounts were given of investigations made in America of penetrating rays found in the upper atmosphere. Professor R. A. Millikan, the eminent American physicist, who was responsible for these investigations, described some further results at a public discourse given before the Association. This summer, in collaboration with C. H. Cameron, he has carried out investigations at Arrowhead Lake, California, with apparatus eight times as sensitive as that previously used. Rays have been found which are much more penetrating than those previously discovered—so penetrating, in fact, that they will go through one hundred and twenty feet of water (equivalent to eleven feet of lead) before they are completely absorbed. These rays are present at sea-level, though to a much smaller extent than at the top of a high mountain. Whether they have physiological effects of importance to our health and happiness is as yet unknown.

A further point of interest emerges from experiments carried out in the High Andes in Bolivia last summer at an altitude of 15,400 feet. The purpose of these experiments was to see whether there is any evidence that the cosmic rays come more plentifully from one region of the heavens than from another. It was impossible to find any such preferential direction. This may, of course, be due to the fact that the refinement of the apparatus used was not sufficient, although it was capable of detecting a variation of five per cent. in the intensity of the rays.

The Earth's Heat.

The papers and discussions at the meeting ranged so far and wide that it has only been possible, in the preceding pages, to focus attention on a few points. Many other matters are doubtless equally deserving of attention. There is an air of almost romantic interest in the title of the paper read by Mr. J. L.

Hodgson, "An Examination of the Problem of the Utilization of the Earth's Internal Heat." The sources from which heat is obtainable are classified as hot surface rocks; molten lavas in volcanic pipes; rocks at moderate temperatures at depths of about five miles; rocks at high temperatures at depths of about thirty miles; and the earth's hot central core. Of these, only the first source is at present exploited (as, for example, at Lardarello, in Tuscany, where three units of 2,500 kilowatts each, utilizing steam from bore holes, are now in operation); according to Mr. Hodgson, the exploitation of the second, third, and fourth sources seems to border on the practicable.

Education Problems.

Two different aspects of the question of education were presented to the education and agriculture sections respectively. The Duchess of Atholl made a strong plea for the extension of practical instruction—educational handwork, etc.—in secondary schools. A number of authorities have stressed its value: Sanderson of Oundle, for example, described how boys considered dull in class developed intellectually when set to work in shops, laboratories, drawing-office or fields. They gained in self-respect and confidence and returned with good results to subjects which previously had been dropped.

Discussing "Agriculture and National Education," Mr. C. G. T. Morison points out that the practical urgent problem is increased production per man with maintenance or increase of production per acre. This would require high technical skill not only on the part of the manager, but also on the part of the manual worker. Mr. Morison insists that it also requires something more, namely, a good general and continued cultural education, which makes the acquisition of technical skill a relatively easy matter. In discussing the education of those who will later become farmers, the importance of the general and cultural side is again emphasised: "What is needed is not a greater volume of technical instruction, but a greater desire for technical instruction and a more educated habit of mind, which I believe can only be obtained in these cases by an improvement in, and a continuation of, general education to a later stage."

Considerations of space bring this necessarily incomplete series of notes to a close; though no other motive would permit the writer (who is not a professional zoologist) to pass lightly over the reference, in Dr. G. P. Bidder's address on "The Ancient History of Sponges and Animals," to the evolution of "that highest of all living creatures, a member of the British Association (Section D)."

The Stone Age in East Africa.

Among the communications presented to the Anthropological Section of the British Association, was a preliminary report on investigations relating to the Stone Age in East Africa which have been carried out by Mr. L. S. B. Leakey in Kenya Colony. Brief references to some of the results obtained by Mr. Leakey and his colleagues have appeared in the press from time to time, but this was the first occasion on which archaeologists in England had had an opportunity of examining the evidence in any detail. Pending Mr. Leakey's arrival in England and a more critical examination of the evidence and the material, the human skeletons and stone implements, which have been obtained, final judgment must be postponed; but so far as Mr. Leakey's results are known, his investigations may provisionally be regarded as one of the most important contributions to the prehistoric archaeology of Africa which has yet been made, even if his conclusions are not substantiated fully in the light of subsequent consideration.

Stone implements of various types, many of them closely analogous to those of Western Europe, have been found in many parts of Africa. In the north, along that strip of the continent which borders on the Mediterranean, the Stone Age culture has been brought into specific relation with the palaeolithic cultures of Europe. But for the remainder of Africa, although the types of the implements justify archaeologists in regarding them as palaeolithic and in assigning them to one or other of the cultures, Mousterian, Aurignacian, and the like, into which the early civilizations of Europe have been classified, evidence as to their date and whether they were contemporary with or later than their European prototypes is lacking. This question of dating, it will be remembered, is a crux of the Rhodesian Skull, which is classified as an early type of man on the evidence of form alone. Some of the stone implements of Africa have been found at considerable depths in undisturbed deposits. While this argues a considerable antiquity, it is no criterion of absolute age in default of any guide as to the length of time the deposits took to form. Argument from analogous deposits, *e.g.*, the deposition of lake or river silt, is fallacious while there is no evidence as to the rate of deposit, a point of considerable importance in an area subject to tropical conditions of rainfall.

It is in relation to this question of chronology that Mr. Leakey and his colleague, Mr. B. H. Newsam, have obtained evidence which on a first examination

appears to be of cardinal importance, that is, if we can accept it as warranting their conclusions that the former high-water levels of Lake Nakuru, to which the geological evidence points, represent pluvial periods in Central Africa which are to be equated with one or other of the glaciations of Europe. The Stone Age of Africa would thus be brought into relation with the palaeolithic period of Western Europe, of which the various stages have been correlated to the different epochs of glaciation with approximate certainty, and a great stride would have been made towards the elucidation of the problem of the origin, age, and distribution of early man in Africa. It may be mentioned in passing that Mr. Leakey's conclusions have the support of Mr. E. J. Wayland, the geologist of Uganda, whose knowledge and experience lend great weight to his views. He, however, is inclined to attribute an even earlier dating to the deposits than is Mr. Leakey at present.

Mr. Leakey's first year's work was concerned with sites in two areas in the Rift Valley, one at Lake Nakuru, one at Upper Elmenteita. On the Lake Nakuru site evidence was found for two high lake levels, and for falls in connexion with these two high levels to a point below the 200-feet level. These are the high levels which are thought to represent pluvial periods to be correlated with the glacial epochs in Europe when there was in all probability a rainy belt stretching across North Africa somewhere about where is now the Sahara. This suggestion awaits further examination in the light of evidence furnished by fossil bones and shells collected from various horizons in the lake deposits. The archaeological site at Nakuru is situated 365 feet above present sea-level, and consists of a deposit along the edge of a cliff. The two upper strata show no sign of submergence, and must be later than the high-water level. In these, through a depth of thirteen feet, were found ten burials with hundreds of tools, pottery fragments, etc., as well as stone bowls, these last more numerous in the upper layers.

A Perfect Skeleton.

One skeleton was in almost perfect condition. It alone afforded possibility of any detailed measurement. The striking features were the length and width of the face, the depth of the mandible at the symphysis or point of the chin, the height of the vault of the palate, and the prominent, relatively narrow, nose, the relation of the breadth to length giving an index of 50.9. The head was very long, in fact, ultra-dolichocephalic. The associated industry is essentially microlithic. Beneath this stratum was a small deposit of pebbles and sand, which appears to have been subject to water action. In it were a few obsidian tools and fossil bones. It is obviously older than the upper two and has been submerged by high lake level. The tools for the most part were backed blades. The occurrence of these small implements, some of which exhibit characteristic geometric form, has given rise to the suggestion that they belong to the widely distributed pygmy implement series of the Azilo-Tardenoisian culture, so-called from its occurrence at Mas d'Azil and in Tardenois in the South of France. The presence of pottery and stone bowls or mortars, possibly indicating a knowledge of grain, would perhaps point to a Neolithic culture.

Pottery and Beads.

The second site at Upper Elmenteita is 393 feet above present lake level. It is situated along the edge of a cliff which consists of lava overlying an alluvial deposit, forming one side of a valley cut out by a prehistoric river during an interpluvial period, and subsequently filled up by a rise of the lake, most of this later alluvium being washed away in a subsequent fall. In the residue were found remains of twenty-six individuals, scattered about at various depths, in pockets in crevices; obsidian tools and pottery and eggshell beads were found with them. It is suggested that they belong to a period previous to the rising of the lake which deposited them where they were found. All the bones are more or less fossilized and well-preserved. The human remains include at least two skull types—a primitive type, Elmenteita A, and a less primitive, but with one or two remarkable features, Elmenteita B. In skull A the striking features are the mandible, which has a very deep bone at the symphysis—41 mm.; the thickness of the bone of the horizontal part of the jaw, the relative height of the ascending part, and the obtuseness of the angle; also the low forehead, the length of face, the width of the cheekbones, compared with the breadth of the skull, and the exceptionally long and narrow nose, index 47.4. The skull is very dolichocephalic, the relation of breadth to length being 68.2 per cent. Skull B differs from skull A in its greater breadth, index 75. The capacity of the skull is exceedingly high, 1680.96; the nose very long and narrow, index 40. Neither of these types resembles the modern negroes of the country.

The third site at Upper Elmenteita is a cave or rock-shelter on the side of a steep valley 216 feet above stream level, and 594 feet above lake level, which has yielded important stratagraphical evidence. Layers 1, 2 and 3 are modern, and contain no tools; 4 is a barren layer of alluvial silt; 5, a layer of rock

rubble from roof; 6, three feet of hearth earth containing pottery, tools, etc., and animal bones; 7, rock rubble from roof; 8, layer as 4; 9, layer of rock rubble; 10, layer of hearths with implements and bones; 11, burials. If, as it is argued on the geological evidence, the two alluvial deposits here are deposits of the two high lake levels, the first prehistoric period belongs to the last interpluvial and the second to an earlier one. Of the prehistoric horizons, the first or later belongs to the Neolithic in culture if not in time, resembling the industry of the first Elmenteita site (Mr. Monroe's farm), while the culture of the second is much cruder and contains no pottery, but rough flakes with just a very small trace of secondary chippings, and associated with it were large quantities of small rodent-like animals. None of the human remains from the lowest level had been taken from the burials at the time of writing.

Lastly, a drift across the Enteril River gives a section across the alluvial plain 330 feet above present lake level. In the deposits of the last pluvial period appear a number of obsidian tools, chiefly lunates and backed points associated with fossil bones and teeth of some extinct form of hippopotamus.

The Month in Brief.

EIGHT TONS OF FOSSILS, said to be the largest collection ever brought home from the Arctic, were collected by the Cambridge geologist, Mr. Harris, and another member of a Danish expedition to East Greenland, led by the explorer Dr. Koch. On returning to Copenhagen they reported the discovery of active hot springs in the neighbourhood of Scoresby Sound.

IMPROVEMENT IN NAVIGATION is the subject of a prize of £100 offered by the Royal Society of Arts, for the Thomas Gray Memorial Trust. A valuable proposal or invention, made by the competitor himself in 1927 or 1928, must be brought to the notice of the Secretary, at John Street, Adelphi, W.C.2, before 31st December, 1928. A prize of £50 is also offered for an essay on "The practice of Navigation in the Mercantile Marine."

A UNIQUE DIRECTORY, recording under thousands of subject headings the centres to which those in search of specialized information should turn, is about to be issued by the Association of Special Libraries and Information Bureaux, 38 Bloomsbury Square, W.C.1, with the assistance of the Carnegie Trustees.

MOUNT EVEREST is again to be attempted by an Italian expedition financed by the city of Milan, if the permission of the British and Indian authorities can be obtained. It is hoped to approach from the Nepal side, which has not hitherto been scaled.

A NEW MATERIAL in the form of pure "vanadium" is announced from America, as the result of researches of the Westinghouse Lamp Company. It has hitherto been known only in its compounds, and no use has so far been discovered for the isolated metal.

PRIVATE LECTURE PARTIES visiting the British Museum may now secure precedence for the use of particular galleries by notifying their intention in advance. Under the rules of the museum not more than one lecture at a time may be given in each room, and the new arrangement is designed to eliminate the inconvenience formerly experienced of finding the room desired already in use.

AN "ARCHAEOLOGICAL ZONE" may be created in Ravenna as the result of further excavations, similar to the area now under formation in Rome. It appears that the palace of the Emperor Honorarius is among the ruins already discovered through the preliminary excavations of Signor Pietro, the curator of antiquities.

ANIMAL NOISES are "played" throughout a new jungle film at the Plaza Theatre, London. These were recorded by the Columbia Gramophone Company, and are reproduced to synchronize with the appearance of the different animals, during the performance, by Amplion loud speakers. By special manipulation of the records, the snarl of tigers is superimposed on the chatter of monkeys, making a medley of jungle noises appropriate to the film.

FUTURE ECLIPSES, dealt with by Dr. Crommelin in *Discovery* last month, when he first announced the results of new researches, were at once quoted from our pages in the *Daily Telegraph* in a leading article.

SIX MILLION MILES had been flown, and ninety thousand passengers carried on regular services, when a few weeks ago Imperial Airways celebrated its eighth birthday. One-third of the entire mail to Iraq is now air-borne by the new route, in seven days. By ordinary mail a letter to Baghdad takes twenty-three days.

THE FASTEST FLYING BOAT of its size in the world is claimed in the new all-metal machine, called Iris II, recently launched in the Humber. It will be used for naval reconnaissance work, is built to withstand rough weather, and can fly for fourteen hours at a stretch.

INTERESTING DEVELOPMENTS may follow a successful experiment reported from Berlin, where a glider was towed by an aeroplane at the Karlsruhe flying harbour. A wire rope of a thousand feet in length was used, and the glider made an independent descent when released by the passenger in it. It is suggested that sections of a "through" air train might land in this way at intermediate points

FRESH LIGHT on the cave culture of Malaya is contained in the latest report of the Federated Malay States Museums Department, which says it has now become evident that this is closely linked with the culture of Indo China. A stage is represented where there has been a rapid passage from a rude type of palaeolithic culture to an early (or poor) type of neolithic, such as the French style "lower neolithic." The art of polishing stones was presumably introduced to the cave-dwellers, whose primitive implements so far discovered in Sumatra do not show this factor.

Beads: A Telling of the Ages.

By Violet M. Methley.

Illustrated with Sketches by the Author.

Beads are of universal occurrence and they have been discovered in connexion with almost every period of history. The cult of these curious objects appears to have been practised since the earliest historical times.

FOR ornament and use, for prayer and healing, by women, Druids, Christian priests and African medicine-men alike, beads have been used in all the ages of the world. There is no era of man's existence which is not told by beads, as it were. Shaped from greyish vitrified clay, they have been found amongst the rough flint implements of the Stone Age; and even these crude beads were an advance upon the teeth of wild animals, strung on thongs, which were thought to give protection against savage beasts and also to endue their wearers with the strength and courage of such animals, a belief still held by certain African and Polynesian tribes.

FIG. 1.
THE GOD BES.
Ancient Sardinian bead, natural size.

The beads of the European Bronze Age show a great advance on those of the Stone Age in craftsmanship. The beauty of jet and amber had been discovered, and the ease with which they could be worked. A jet necklace of this prehistoric period (Fig. 2), gives one quite a reminiscent shock—it is so precisely like those ornaments of jet which used to be sold at Whitby and elsewhere, and were worn by our grandmothers and great-aunts!

Later, in the semi-historic times from which the dim figures of the Druids emerge, we find these mysterious priests making a cult of the bead. It has become an object of worship. The Glain-Heidyr, or holy "snake-beads," may give in their name a hint of their material, for the Irish "gloine" and the British "glaine" seem both to derive from the Phoenician term for "glass,"

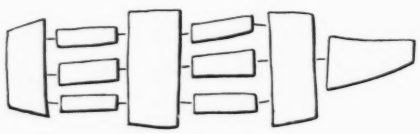


FIG. 2.
JET BEADS OF THE BRONZE AGE.

and to suggest their origin. But the Druids made a different claim. Higgins, in his work on the "Celtic Druids," explains their theory as follows:

"It is a congeries of small snakes, rolled together and encrusted with a shell, formed by the saliva and viscous gum, or froth of the mouth. The egg is borne in the air by the hissing of the snakes and, before it falls to the earth, should be received in a napkin, lest it be defiled."

Pliny, who called the snake-bead *ovum anginum*, gives a painstaking description: "I have seen the egg," he writes. "It is about the size of a moderate apple, its shell and cartilaginous substance full of little cavities; it is the insignia or badge of distinction, which all Druids wear. They think that nothing equals the Anginum for getting the better of their adversaries in any kind of danger." That this belief in the magical powers of the snake-bead spread to the Roman invaders is shown by Pliny's further assertion that:—

"Claudius Caesar ordered a Roman soldier of the Vesontian family to be put to death, because, when he had a trial at law before a judge, he brought into Court, in his bosom, the Anginum."

From the account of Pliny and others, it would

FIG. 3.
SNAKE BEADS WORN BY THE DRUIDS.

seem that the Glain-Heidyr may have been some kind of *Echinus*, or dried sea-urchin, but it is certain, also, that artificial beads of a greenish-blue glass were worn during the Druidic period. They are often found in the burial-places, some fluted, some flattened, pierced with a hole large enough to slip upon the finger, although they are thicker than a ring. Owen tells us that these "adder beads" (Fig. 3) were especially worn by the bards, every order adopting a different colour. Whatever their composition really was, the people in general were told that the snake beads were of natural—or rather of

supernatural—origin, and the belief in their magical powers survived down to almost modern times. Bishop Gibson, writing towards the middle of the eighteenth century, said that they were still to be found, sometimes twenty and thirty together, and that the country-people believed that they came into being on Midsummer Eve, when the snakes gathered together, and "blew" these mystical beads, like clear glass, by hissing.

So far we have thought only of Northern Europe, but the cult of the bead prevailed in other lands, amongst all the ancient peoples. They are found

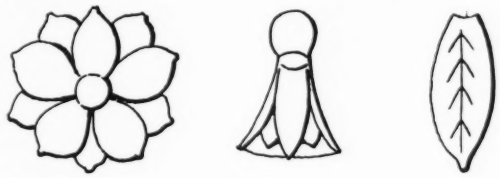


FIG. 4.
EGYPTIAN BEADS OF 3000-4000 B.C.

amongst the remains of the old races of America, often beautifully carved in jade or vitrified volcanic material; and amazingly minute bead-work was also executed by another ancient people, the Hittites. Fragments of a cloth-of-gold material has been discovered in their tombs, which is woven from infinitesimal beads of gold, strung upon silk threads.

In ancient Egypt bead-making was raised to the ranks of a fine art. In life and in death they wore beads: so prized they were that one in particular, the well-known Bead of Queen Hatasu, was of greater value in its day and more celebrated than the Koh-i-noor. It was inscribed with the Queen's name and birth-date, and it was an amulet, to be carried all her life, and laid within her mummy-case at death. The beauty of some of these Egyptian beads must be seen to be realized. Many of them date back to three and four thousand years B.C., and the workmanship is fine, even in the earliest. The small green, blue and brownish beads, still to be found amongst the desert sands, are the most insignificant. Varied materials were used for these beads—gold, steatite, crystal, haematite, or the semi-precious stones like garnet, amethyst, cornelian, and turquoise. But some of the most beautiful, which have been wonderfully preserved in the clear dry atmosphere of Egypt, are of glazed faïence, in exquisite colouring. Deep blue, brilliant turquoise, clear yellow, vivid green,

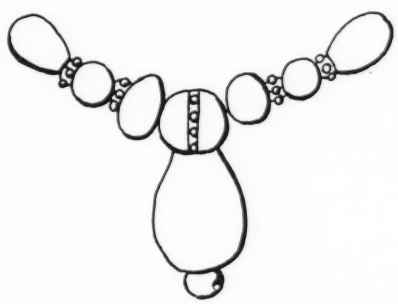


FIG. 5.
NECKLACE DISCOVERED AT HERCULANEUM.
Blue and green glass beads, interspersed with small ones in chased gold, and suspending as pendant a dried fig.
(About one-third natural size.)

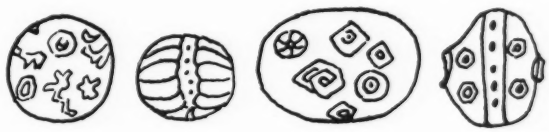


FIG. 6.
EARLY ETRUSCAN BEADS WITH MODERN VENETIAN COPIES.

shaped like lotus-flowers, daisies and campanula blossoms, these beads (Fig. 4) strike an incredibly modern note, both individually and in chains.

There is one great necklace or "collier" of the XIth Dynasty, found at Deir-el-Bahri, once the ornament of a priestess or queen, which is extraordinarily decorative, formed of alternating rows of blue, white, and black beads. Other beads, intended to be used as amulets, represent the sacred symbols of Egypt—the Ankh, or Key of Life, the Key of the Nile, the scarabaeus—most of all the Eye. Some are shaped like animals, some represent legs, arms, and other portions of the human body. These may well have been intended as "votive" beads after the fashion of the waxen legs and arms in continental churches. That beads were offered by the Egyptians to their gods is certain; there is a votive necklace of blue beads which belongs to the XVIIIth Dynasty.

A curiously modern atmosphere hangs about the elaborate beadwork of the Egyptians, executed as it is in thousands of tiny porcelain beads upon a canvas background. It was precisely after this fashion that our great-grandmothers made those bead bags, bracelets, and footstools, the cult for which has been revived of late years. But Egypt can also show giants amongst beads; some, of bright blue porcelain, from Thebes, are six and seven inches long.

The pervading influence of Egypt can be traced in the beads of Mycenae, that ancient civilization. These are of blue glass, earthenware, stone, and clay, often flower-shaped, with the petals executed in different colours. More costly and very beautiful are the gold scarab beads and other golden beads of exquisite workmanship which have been found in Cyprus, although the earliest Cyprian beads are of clear, yellowish glass. The beads of ancient

FIG. 7.
INDIAN NATIVE PRIESTS WEARING ROSARIES.

Greece, as one might expect, were artistic and beautiful. Some of the earliest are of dark-red amber, rich and deep in colour and banded with gold. Others are of crystal, formed like flowers, whilst brightly-coloured earthenware beads, in various designs, belong to an earlier date. Ancient Sardinian beads of terra-cotta again show the influence of Egyptian ideals, and are shaped into the head of the god, Bes (Fig. 1).

The early Etruscan beads are very interesting. They are made from cornelian, from plasma, from gold, but, above all, in glass. And these glass beads, in all shapes and colours, with their squared and spiral designs, have been copied since, all through the ages, with extraordinary exactitude, by the Venetian bead-craftsman (Fig. 6). The Etruscans also set a fashion which the Romans were later to copy—the fashion, that is, for wearing a huge bead, or "bulla," suspended from a necklace of smaller beads. These "bullae" were generally made of embossed gold, and they became a perfect craze amongst the Roman exquisites under the Empire, who wore them suspended by a long gold chain. The Romans, indeed, developed a perfect passion for beads of all kinds. Trebellius speaks of the great commerce, in his day, in "gemmas vitreas, bullas vitreas," and Clement of Alexandria inveighs against the money spent on beads.

Some wonderful necklaces were discovered at Herculaneum; one, very unique in its way, is formed of blue and green glass beads, interspersed with others in chased gold with, as a pendant, or bulla, a dried fig, set in gold (Fig. 5). It was probably worn as an amulet, just as dried cloves and nuts of various kinds are worn still in the East. The "bulla" habit seems universal. They have been found in ancient Irish tombs, and have been revived in our own day in the shape of the big "blobs" of jade, crystal, amber, or what you will.

Meantime, whilst beads, as ornaments, were worn by all classes in the ancient world, the Phoenicians, those indefatigable commercial travellers, were already making use of them for purposes of trade. Beads, after the Egyptian type, shaped into cats' heads, "eyes," and other forms, were made at Tyre and Sidon and used as barter. These Phoenician beads are found very widely distributed, especially over Africa, and it is probable that we have here the origin of the mysterious "Aggrys"—about which more later.

It was during the Middle Ages that beads assumed a definite religious significance, and were christened, as it were, in England by that name which they have borne ever since—"Bede"—that is to say, "prayer." The Christian use of bead rosaries goes back at least to the time of St. Augustine, A.D. 366, but it was some centuries later that the "Paternostri" became a distinct trade guild—the makers, that is, of beads for chaplets, or "paternosters." Art and fashion extended to the rosary-wearers. If the great ladies of the Middle Ages wore their beads "with a difference" their chaplets were marvels of workmanship, the beads of ivory, gold, or jet, carved and fretted, shaped sometimes like tiny skulls. And—with a difference also—a rosary blessed by the Pope, or by some other holy man, was considered just as much a luck-bringer as the bead amulets of ancient Egypt. But if beads had become symbols of religion, even in their name, already, at the beginning of the fourteenth century, a shrewd traveller and man of business had, like the Phoenicians of old, seen their value commercially.

Venetian Glass Beads.

From early times, glass had been made at Venice, where the needed materials for the craft were near at hand. The Murano workers were already making "paternoster" beads of beautiful workmanship, manipulating the glass within each bead into twelve-pointed stars, to represent the twelve apostles. At the beginning of the fourteenth century, Marco Polo, the explorer, became possessed of an idea which might enrich Venice, his native city. It was not original—we have seen that the Phoenicians used

trade-beads—but Polo had seen the immense value set by the Africans and by other natives upon beads, especially those known as "Aggry" or "aggri" beads. The mystery of these beads extends to their name, a word the origin of which has not been fathomed. Their devotees claimed for them a natural origin; the African natives persisted in saying that they came from the bowels of the earth, and that seekers were guided to the place where they were buried by spirals of vapour rising from the ground. Leyden writes:—

"The aigrie is a kind of stone of a greenish-blue colour, supposed to be a species of jasper, well-perforated pieces of which are valued at their weight in gold, and used for money."

On the other hand, in 1700, Bosman spoke of a sort of blue coral, which the Europeans called "Agrie" and the natives "Accorri."

Aggrys were of various colours, but the blue ones were valued most, not only for their price in currency, but also because they were accounted very potent charms. In cases of sickness amongst children, ground aggry beads were administered and their powers of enchantment and wonder-working seemed to be absolutely unlimited. If buried in sand, they would multiply in numbers; they could be used to find water in the desert, or even to direct searchers upon the path of a wanderer. Suspected criminals were compelled to swallow aggry beads and, if the dose killed them, they were regarded as undoubtedly guilty. In 1817, Brodrick saw them worn at Commassi by the King of Ashanti, in a long necklace reaching below his waist, and saw too that they were regarded as something sacred.

But beyond all this, the aggry beads were currency—coin of the realm, with the different varieties valued at different prices, and this perhaps gives us a clue to their real origin. Another clue is the fact that they have been found in England, and even called there by the same name. There is a record of "Aggry" beads being discovered in Lincolnshire, which are described as being as large as an apple, black and speckled. This seems to point to the conclusion that the aggry beads were Phoenician in origin—some of those very glass beads, made at Tyre or Sidon, which they used for the purposes of barter. It would account for their presence in such widely-divided countries—for the Phoenician merchant-venturers travelled far—and it would also account for their persistent money value in Africa. Doubtless they would have been copied again and again, but the same general appearance would have been preserved, in order to retain their currency value.

FIG. 8.
AN INDIAN WOMAN'S BEADS.
In the East the cult of beads still holds its own most firmly, and tens of strings are worn where one would serve with Western women.

In any case, Marco Polo determined that his fellow-Venetians, with their unique opportunities for the manufacture, should be the ones to set up a fresh mint of beads, as it were, and the trade which he initiated grew and flourished and persists to this day. Some idea of the extent of it may be obtained when we learn that in 1764, five hundred and sixty-two varieties of trade-beads were made at Murano, with vast numbers of sub-divisional species. For the same kinds of bead do not serve as currency in all parts of the world. Those called "Reych," for instance, were, at one time, wholly made for Surat in India, where they were worth some fifteen dollars per thousand. The Venetians had as many names as varieties: "Renown," "King's Saddle," "Whore's Eye," "Hassan Bey," "Tiger's Tooth"—these are some of the queer titles of the money beads.

The influence of the Renaissance extended to beads. Some of those wrought by the Italian craftsmen of the great age are most exquisite in workmanship, especially those carved from semi-precious stones

and inlaid with gold. Their value as ornaments was still often veiled under the semblance of religion. When the austere Savonarola complained of the worldliness of wrought and beautified rosaries, a spirited Italian dame made answer that she could pray better when her beads were adorned to the glory of God !—a rather disconcerting reply.

A queer recrudescence of the belief of beads as charms was seen in the "Anodyne Necklace," which was so extensively advertised by a certain Dr. Turner at the beginning of the eighteenth century. This necklace was made of beads of white bryony-root and, as it was firmly believed, would infallibly relieve infants who were cutting their teeth with difficulty.

The discovery of America brought into the knowledge of Europe another use for beads. Amongst the Red Indian tribes, they took almost the place of printing, and of writing materials, and treaties with the white invaders were executed and confirmed by means of "Wampum Belts" on which the terms were set forth in beads.

Although the cult of beads still flourishes with us, and they are worn almost more nowadays than ever before, it is in the East that they still hold their own most firmly, both in the secular and religious life of the people. They are used for the adornment of women-folk in India, and here some hundreds of bead-chains will be worn where one would serve with us (Fig. 8). But the practice of using them in connexion with prayers is more prevalent in India and other parts of the East than even in the Catholic countries of Europe. The use of rosaries probably came first from the Brahmans, then passed to the Buddhists and Mohammedans, and may quite well have travelled in this way to Europe, also, through the Crusaders. Yet, in the East, one rarely sees the rosary being actually used. This is because worshippers conceal them, when praying, in order to avert the influence of the evil eye. They are "told" inside the little bag which contains them, or hidden in the corner of a scarf. The telling of the rosary is a matter of great importance in the East—more meritorious than acts of mercy or burnt offerings. The beads used are of many materials, according to the particular sects of the wearers—glass, coral, ivory, shells, bone, precious stones, and seeds and fruit of various kinds are used in their making. The numbers of beads also vary according to the sect, the votaries of Siva using a rosary of thirty-two beads, and repeating, as they tell them, the 1,008 names of the god. The worshippers of Vishnu use a chain of one hundred and eight beads, and this is also the number found in the rosaries of the Thibetan Buddhists.

Rosaries are constantly in use, and more plainly in evidence amongst the ascetic priests and fakirs of India (Fig. 7). Especially favoured are those made of the Rudraksha berries—peculiarly sacred since legend has it that they were first created from the tears of the god, Siva, shed when in a passion at sight of the wickedness of mankind. But perhaps the fullest expression of beads used in this manner is to be found in the description of Captain Hawkins, when he speaks of the orisons of the Great Mogul:—

"At his devotion, he had eight chains of Beads, four hundred in each chain; he turns over his Beads at each time a thousand, two hundred words—and thus his prayer is ended."

The Treatment of Infection.

A Chemical Problem.

In the following discussion of the treatment of infection a medical correspondent suggests some limitations of modern medicine and the problems still to be overcome.

THE vast majority of deaths that occur before the age of forty are due to infection by well-recognized micro-organisms. Between them two only, the tubercle bacillus and the pneumonia coccus, account for the majority of these deaths. Such deaths are truly accidents. To be slain by a bacillus is no more inevitable than being run over by a tram.

The remedy is obvious. Let us kill our bacilli, wherever they are. Outside the body, let us kill them by sunlight, cleanliness, and personal hygiene. Inside the body . . .

And there the problem begins. It is possible to kill a bacillus by very simple means. Carbolic acid is a favourite method. At a concentration of one quarter per cent it will prevent the multiplication of most bacilli. Why not use carbolic acid? Well, Lister did. He sprayed carbolic acid throughout operating theatres. And the results were, frankly, bad. It was not until he gave it up, and determined to kill microbes before they got to the wound rather than when in it that he won the day.

The problem still remains with us. It has scarcely

been solved, even to the smallest extent. The explanation is simple. Any chemical that destroys micro-organisms also destroys the very delicate mechanism of the body which, in itself, combats infection.

A beautiful demonstration of this fact is given by recent work of Sir Almroth Wright. If the blood of a healthy person be taken, and to it a number of living microbes be added, only a very few will grow. In practice, the blood is run in between two glass slides which are separated by a slip of paper. The living bacilli give rise to colonies, which can be counted. If carbolic acid be added to that blood, the result is surprising. Actually many more colonies grow than were found in the blood in its pure state. The first effect of all known antiseptics is to destroy the body's defences.

Failure and Success.

Much has been heard of the gold treatment of consumption. A compound of gold is injected which, it is said, will kill tubercle bacilli; in the present writer's experience a series of cases did, in fact, show no improvement. Sir Almroth Wright has shown that actually the bacilli grow better in blood to which the compound has been added than in pure blood. In the main, therefore, sterilization in the body has failed. But there are exceptions. The best known is Ehrlich's famous arsenic compounds, which have made syphilis a curable disease. The treatment is not without danger. In Ehrlich's hands there was, in the experimental stage, a severe mortality, and to-day occasional deaths occur. Moreover, in all cases there is some transient liver damage, negligible compared with the advantage obtained. But here is a drug that certainly kills the organism of syphilis in the body better than it does outside it. Quinine in malaria is another even more familiar example. And there are now drugs which can produce similar effects on the organism of tropical sleepy-sickness.

But these three diseases are not due to bacteria, that is to say, to primitive plants. They are caused by creatures which have much more in common with animals. For practical purposes, the infectious diseases have not so far been cured by chemicals, however administered. An attempt has been made to cure them, in their more acute and dramatic forms, by the injection of minute quantities of such drugs as mercury. Young, in America, has prepared a drug known as Mercurochrome, of which much is claimed. Certainly the drug is not present in the blood in a strength that can kill microbes. It might produce, theoretically, effects in some indirect manner but practical experience has, up to the present, been disappointing.

Not only, however, is the "chemical" cure of infectious diseases not impossible; it is, in fact, a daily occurrence. The body, we must believe, kills its microbes by "chemical" means. There is certainly a chemical basis of life. Living tissues have been analysed; many of them have been manufactured; urea, sugar, and many other substances not found in nature save as the products of life can easily be made in the laboratory. We are forced to believe that there is a chemical formula which may be assigned to that substance, present in healthy blood, absent from blood from a patient suffering from infectious disease, which slays, in laboratory conditions, a microbe. We make our "anti-toxins" to-day by laborious biological means. We use the horse to manufacture them. Readers of "Martin Arrowsmith" will remember that one of the characters in that book succeeds in making anti-toxin in his laboratory. Alas, that character—though recognizably founded on a well-known scientist—has not yet, in real life, achieved that great success. But one need not be an H. G. Wells to foretell that result with complete confidence. How, to-day, do we combat infections? Frankly, we scarcely do so at all.

Where an organism produces a toxin, or poison, under artificial conditions, we can induce a horse to yield us an anti-toxin. So we cure diphtheria, tetanus and dysentry; where it does not—as in pneumonia—we are really helpless. We treat symptoms instead of tackling root causes and effects. And in some cases we are inefficient in the treatment even of symptoms. But that is another question.

The Chemists' Opportunity.

There is room, in fact, for the profoundest dissatisfaction with our modern toleration of our ignorance of the chemical constitution of living matter. There are comparatively few fully-trained chemists in Europe examining living matter. Bio-chemists there are, in abundance; but many of them are spending their time estimating the sugar in blood by the different techniques, and comparing results. If the time and ability that has been spent on metallurgy were spent on medicine, we might be able to manufacture anti-toxin to-day as readily as we can make cobalt steel. Young chemists, afire with enthusiasm, are always seeking new fields to conquer. Let them therefore turn from the aniline dyes, and study bio-chemistry.

The Month's Wireless Developments.

COMPLETION OF THE IMPERIAL SCHEME.

WHILE the past few weeks are chiefly associated in the minds of English listeners with the beginning of alternative programmes, available since the opening of the 5 G.B. experimental station, the event of most importance to the Empire has been the completion of the beam wireless scheme. As foreshadowed in these notes in August, when details were given of the South African service, the last link in the chain between the Dominions was forged with the opening on 6th September of beam communication with India. The scheme decided upon by the Government in 1923 has thus been successfully completed; and as beam stations for direct communication between Canada and Australia also are expected to be opened in the near future, it may justly be claimed that the British Empire now possesses the most complete and up-to-date wireless telegraph service in the world.

Future "Beam" Possibilities.

The completion of the Indian beam stations, however, by no means closes the immediate prospect of improving Imperial communication. New experiments have proved the possibility of carrying on telephone conversation by means of the beam stations simultaneously with the operation of the telegraph services, and there is every prospect that before the end of next year it will be possible for telephone subscribers in England to call up subscribers in any of the Dominions. Further, with the development of a system of facsimile transmission specially adapted to the beam system, there is also the prospect of written and printed matter as well as photographs being transmitted to many parts of the Empire.

The English transmitting station of the Indian service at Grimsby, and the receiving station at Skegness, are connected, as is the case for the other beam services, by landlines to the central telegraph office at the G.P.O. in London, from which the actual operation of the station is automatically controlled. The corresponding stations in India, situated at Kirkee near Poona, seventy-five miles east of Bombay, and at Dhond respectively, are similarly linked with the central telegraph office in Bombay. The receiving station at Dhond is identical in design to the Skegness station, but there is an interesting modification in the method of automatically controlling the transmitter and receiver of the stations built in India. The normal control at the English beam stations is by means of a high-speed "Wheatstone" transmitter, installed in the London central office, which sends ordinary telegraph signals along the landline to a relay on the beam transmitter, this in its turn keying the transmitting apparatus. The signals received at Skegness from India likewise pass from the receivers through a relay, and are converted into telegraph signals that travel by a landline to the central office.

New Use of the Landline.

In the case of the Indian stations, however, a system of control known as "wired wireless" has been adopted: instead of ordinary landline telegraph signals being used for the control of the stations, signals of wireless frequency are generated and sent along the landline. By adopting frequencies sufficiently wide apart, it is possible to work a number of control services on a single landline, in addition to which one or more telephone conversations may be conducted by means of the same landline, without mutual interference. Whereas in wireless transmission the energy is radiated into space, "wired wireless" signals are sent along the solid copper conductor. The advantage of using a single landline in this way for the control of a transmitting and a receiving station—while at the same time telephone conversations are freely conducted between the central office and wireless stations, or between the stations themselves along the same line—is obviously of considerable value in regions where there are difficulties in providing additional landlines.

The Daventry Experimental Station.

The British Broadcasting Corporation wisely forestalled the criticism which naturally accompanied the general enthusiasm at the opening of the new station at Daventry by calling this "5 G.B. 'Experimental.'" As the chief engineer, Captain Eckersley, pointed out in the *Radio Times*, the problem is at the moment largely a technical one. Inevitably some listeners say that the new station is much too strong, and because of it they cannot now hear this or that other station; while others say that it is too weak because they have been used to living close to the old local Birmingham transmitter, whose functions 5 G.B. has assumed. "But these local difficulties will soon disappear," Captain Eckersley states. "I would add the word of warning that the service is *experimental* and we cannot guarantee the same freedom from breakdown as in the case of our other transmitters. 5 G.B. is an experimental station. Its design has been evolved in a comparatively short period, by trial and measurement. It was felt that it would be a pity to deny listeners an alternative service just because it might be less regular than normally. But, after all, the service is alternative; if breakdowns occur in it, the listener is left with a programme from 5 XX." As to the success of the experiment, the main points on which the B.B.C. are definitely seeking guidance by practical experience include the extent of the service area, within which reasonable service can be guaranteed to the average listener who possesses a simple receiving apparatus; and the technical problems incidental to the operation of a new type of transmitter, a novel form of circuit being used at 5 G.B., which it is hoped will be distinctly superior.

Long Distance Flights.

In view of the number of machines which have been lost in the recent Transatlantic flights, there has been considerable discussion in the press on the conditions that should govern such attempts. Opinion has not been unanimous on the justification for hazardous ocean flying, but it is generally agreed that the machines employed should first be proved suitable. It is therefore surprising that certain aviators should have disregarded the obvious precaution of carrying wireless apparatus, especially as this overlooks—at least so far as British machines are concerned—the powers of the Secretary of State for Air to insist on their doing so. The explanation has in one case been advanced that the extra weight of the apparatus was better employed for spare fuel, and it is therefore of interest that this difficulty has been overcome in the case of the wireless outfit designed for the Dornier-Whale seaplane in which Captain Courtney flew to Spain, in the course of an Atlantic attempt since abandoned under official orders.

Following the latest practice, power for the transmission of messages is obtained from a wind-driven generator, mounted in the slip-stream from the main propellers, which also supplies current for the lights on the machine as well. Previously it has been necessary to carry two separate generating installations for these functions, and the new device has thus saved Captain Courtney a considerable amount of additional weight. The aerial for his set is of ordinary trailing type, about 200 feet in length, but the contingency of a forced landing is provided for by the installation of a special emergency aerial, to enable the aviators to send out a distress call while on the water.

In this connexion, no less than for its value to ships, one of the most interesting wireless exhibits at the Shipping, Engineering and Machinery Exhibition held in London last month, was the Marconi " Auto-alarm " which has been designed to respond to the alarm signal when the wireless operator of a ship is off watch. The alarm signal is sent as a preliminary to the distress (S.O.S.) signal, and consists of a succession of four-second dashes, which actuates the receiving instrument and causes bells to ring on the ship's bridge, in the wireless room and in the operator's room. This ensures that the operator is recalled to his instruments in time to receive particulars of the distress message which follows the alarm signal. The Auto-alarm has been subjected to stringent tests, being officially approved by the Post Office as complying with the specified requirements, and it is now being fitted on many ships.

Some notes on the National Radio Exhibition, which opened in London on September 24, will be contributed to our next issue.

(The series which the Manchester Station Director of the B.B.C., Mr. Edward Liveing, is contributing on " Broadcasting : A New Social Force," will also be continued in November.)

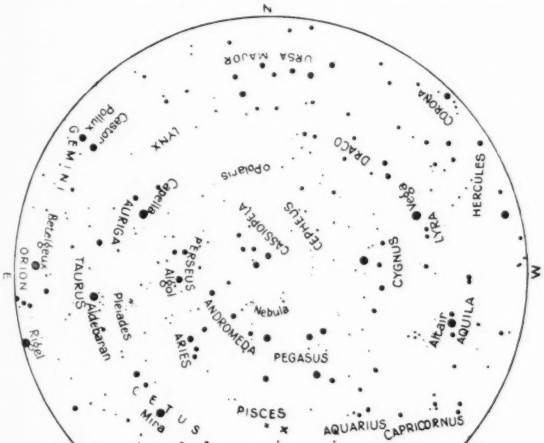
Among the Stars : A Monthly Commentary.

By A. C. D. Crommelin, D.Sc., F.R.A.S.

Late of the Royal Observatory, Greenwich.

THE FACE OF THE SKY FOR OCTOBER.

JUPITER, Uranus and Mira Ceti, mentioned last month, continue to be suitably placed for observation. The red spot on Jupiter has regained some of its red colour. Rev. T. E. R. Phillips notes that there is a series of small black spots on the south temperate belt. Those who are able to observe in the " small hours " should note the conjunction of Neptune and Regulus in the early morning of 27th October. They rise about half-an-hour after midnight, Neptune being 88½ seconds of arc north of the star. Neptune's motion is so slow that the two will be in the same field for several days. This is the first and closest of a series of five conjunctions of Neptune and Regulus ; the others are in January and August, 1928, and April and June, 1929. Neptune is the only planet that can pass five times through conjunction with a star. It is a result from the fact that its annual retrograde movement is more than half as long as the forward movement. Venus is well placed in the morning sky during the month, being at its greatest brightness on the 17th, when it rises about 3 a.m. Its disc is only one-seventh illuminated on 1st October, three-eighths on 31st October. The rotation of Venus is a puzzling problem. Mr. H. McEwen (B.A.A. Journal, No. 8), gives reasons for accepting Professor W. H. Pickering's suggestion of a rotation of sixty-eight hours about an axis nearly in the plane of the orbit. If any markings should ever be seen on the disc, they should be carefully drawn, and watched for motion.



THE SKY AS SEEN FROM LONDON

at 0 h. sidereal time, that is, 11 p.m. on 7th October, 10 p.m. on 22nd October. X x show the positions of Jupiter and Uranus in the middle of October. Mira Ceti is now near its maximum, and should be observed. The chart is, of course, drawn for *overhead* observation, as indicated by the positions of the horizons

The Age of the Planets.

There has been a good deal of controversy in recent years about the physical condition of Jupiter and the other giant planets. Half a century ago the view was widespread that they were still in a semi-sunlike state, with molten surfaces and intensely heated atmospheres ; the well-known astronomical writer, R. A. Proctor, was a strong advocate for this view, and probably his books played a large part in securing its general acceptance. But at that time most people assigned a far shorter duration to the planetary system in the past than they do now ; Lord Kelvin's calculation of twenty million years for the age of the sun could not be gainsaid so long as the assumption was made that the whole of its energy was derived from the coming together of its particles from a great distance. At present both geological and physical considerations lead to an estimate of at least a thousand million years for the earth's past duration ; one result of this increased estimate is the conclusion that the sun and stars are drawing on the almost unlimited stores of energy locked up in their atoms.

But the longer estimate makes it more difficult to suppose that the surfaces of the giant planets can still be molten.

Calculations by Dr. H. Jeffreys claim to prove that they must have solidified ages ago; he goes on to assert that their central regions are formed of solid ice, thousands of miles thick. This view leads to the corollary that the great energy that produces such startling changes in Jupiter's atmosphere comes wholly from the sun; since the energy is reduced by distance to 1/27 of that on earth and, further, since Proctor gave good reasons for concluding that many of the atmospheric disturbances have their origin far below the visible surface, I think we must conclude that there is still a good deal of heat in the interior of the giant planets. I suggest as an alternative that, while their surfaces may have solidified, there is still mighty volcanic energy in their interiors, and that their eruptions are so violent as to produce marked effects in the cloud layers above them; even on earth the Krakatoa eruption in 1883 produced atmospheric effects that were sensible all over the world; and we may postulate much greater energy in Jupiter, owing to its greater mass, and presumably a higher internal temperature.

Temporary Stars.

Novae or temporary stars are now detected nearly every year, but most of them are too faint for naked-eye observation. The latest one was detected by Professor Max Wolf of Heidelberg, who found it on plates exposed on 30th and 31st July in the region of Aquila. Photographically it was of the ninth magnitude, but owing to its red colour it was fully of the eighth by eye observation. No trace of it appears on twenty-five exposures made between 1892 and 1926, but examination of plates taken at Harvard and Bandoeng Observatories shows that it appeared in June last; it was invisible on 8th June, but on the 27th it was of the eighth magnitude or brighter. It is declining slowly, and may still be within reach of small instruments, so I give its position: Right Ascension 18 h. 52 m. 12 s., South Declination 3° 25′.

Telescopic observers who desire to identify faint objects will find Max Beyer's star maps very useful. They extend from the North Pole to 23° south declination, and cost twenty-four shillings the set. Dr. G. Merton, who is now at the Royal Observatory, Greenwich, is willing to procure sets for those who desire them. It may be well to give a reminder of the transit of Mercury on 10th November; the last contact occurs one hour twenty minutes after sunrise; further details will be given next month. There was a transit three and a half years ago, but there will not be another for thirteen years.

The Cape Observatory.

The annual report of this observatory has now come to hand and gives evidence, as usual, of great activity. In the few years that Dr. Spencer Jones has been there he has published researches on the motions, distances and masses of the sun, moon and planets. The Cape section of the great astrographic catalogue is now practically complete, the final volume being almost ready for publication. Dr. J. Lunt has retired from the observatory after thirty years' service. His work was stellar spectroscopy with the Victoria telescope. This instrument is now being used for stellar parallax work which will be very useful, since the southern heavens have not been so completely surveyed for parallax as the northern.

Correspondence.

"BIRD-MIGRATION."

To the Editor of DISCOVERY.

SIR,

The beautiful target which Commander Acworth presents, and the desirability of exposing the errors which he is so industriously propagating, tempt me to comment on a few of the points Professor Patten has not already dealt with, and incidentally on some of the Professor's own remarks.

The Commander's ignorance of birds leads him into as many and ludicrous errors as he exposes in certain ornithologists equally ignorant of aero-dynamics. He imagines that in confuting those writers he is confuting accepted ornithology. He is wrong. Such mistakes are made, with depressing frequency, but he will not find them in the standard authorities—for example, in Dr. Landsborough Thomson's "Problems of Bird Migration," (1926), to which he makes not the slightest allusion, although a discussion of the subject can hardly be profitably carried on except upon the basis there provided.

I will give one instance of migration as it actually happens. On 7th September I watched a steady stream of swallows migrating over the North Bull, in Dublin Bay. They were coming down the east coast of Ireland in a southerly direction, turning west at Howth to follow the north side of the bay instead of striking across its mouth to Dalkey, the opposite jaw, which was plainly visible. At the point where I watched they were heading uniformly *north-west*—in precisely the opposite direction to the winter quarters they were making for. The wind was westerly and fairly strong. These were migrating by day at about twenty-five air miles per hour, as swallows normally do; instead of not "deviating a hair's-breadth" they actually turned at Howth to fly several miles against wind in the wrong direction, rather than save half the distance by a simple crossing of half-a-dozen miles over calm sea to plainly visible land on their true course. Dozens of individual birds and small parties made this choice, and I could see none using the alternative; moreover, their behaviour was quite typical. Both Professor Patten's theory of visual bearings and Commander Acworth's blind bee-line seem to be very hard to reconcile with what actually takes place.

The Commander is obsessed with the idea of sea-crossings, which as Professor Patten says are a very minor factor. Many British swallows migrate at least 6,000 miles to the region of Natal, and 120 miles would be a safe average for sea-crossings involved. Thus 98 per cent. of their route is overland. If Commander Acworth will study "wind charts" with reference to birds (as he advises other people to do), he will find the forces thus recorded quite tyrannically affecting migrations. (Cf., for instance, Schenk's detailed study of woodcock migration through Hungary.) Even on currents he is not unimpeachable. He says "the effect of a belt of wind of 30 m.p.h.—increasing with altitude—is startling. . . . " It is, though his readers would be in a better position to see why if he had mentioned the fact that it not only increases with altitude, but changes direction. Here is something for him to speculate about—birds have repeatedly been found flying at high altitudes against a wind, sometimes so stiff that their ground speed was practically *nil*, when it they had only travelled a few thousand feet lower the wind would have been behind them. I am not giving this as proof that birds prefer to face the wind—which I much doubt—but it hardly reinforces the Commander's arguments on this

point. Professor Patten has vindicated memory; I will add one concrete example. Ringing has shown (*a*) that males commonly reach summer quarters before females; (*b*) that nevertheless females will rejoin the same mate year after year—even nine years running. How is this personal reunion explicable except as a clear case of memory? Of course, any sober ornithologist would agree with his condemnation of the anthropomorphism by which such attributes are often misrepresented.

As anyone who takes the trouble to compare temperatures with migration dates is aware, there is no correlation. In spring birds push forward into *colder* regions, and hordes leave in July and August long before temperature falls to the level at which they arrived.

Professor Patten's argument seems to be underlain by an assumption that food shortage is the direct cause of migration, and he further says "that the impulse for birds to move off has become inherited." Why "*become*"? Dr. Landsborough Thomson has already shown up the drawbacks of a view of migration as being set in motion by food shortage. And why presuppose a wish to stay at home, countermanded by a necessity for evacuating it? I should say it is much nearer the mark to believe that all birds migrate except those tied to the breeding place permanently by some particularly strong bond. Of course, many migrate only a few miles, or even less. There is little to be gained by trying to discuss so complex a subject in so little space. I hope I have shown that scientists are not all so benighted as Commander Acworth in his innocence assumes, and that whoever hopes to advance a solution of migration must first equip himself with a wide and thorough knowledge of the innumerable facts. Otherwise he wastes time; theories are easy but facts are hard.

E. M. NICHOLSON.

Dublin. 10*th September*, 1927.

To the Editor of DISCOVERY.

SIR,

In the September issue of *Discovery* it is very pleasing to read Professor Patten's advocacy of the bird as a "bright little, intelligent, sparkling-eyed creature, full of life and powers of observation," and it is to be hoped such form of esteem may be upheld by researches that may be made into the delightfully interesting phenomena of migration and wind-aided flight. Commander Acworth, in support of his slight dissent, postulates the exact case of a bird able to fly 180 miles in calm air at a speed of thirty miles an hour, and then assumes the same bird to be flying in a wind of twenty miles an hour, blowing, let us say, from the north. He would then advise us that "the bird cannot *elect* to fly head to wind for the reason that it cannot—except after alighting or standing on the ground—tell from what direction it is blowing." But how is anyone with reason and observation able to doubt that the low-flying bird, so evidently endowed with keen sight and alert mind for all the purposes of life, must perceive quickly that when flying in one direction—the northward—it makes slow progress over the landscape, in comparison with the fivefold rate of progress it can make in the opposite direction! Accordingly it cannot help distinguishing the one direction from the other, and so elect at pleasure to fly in either. Only in thick mist and darkness, which are known to distress migrants, may the bird not be so well able to *discern and sense* the direction of the wind and choose a course with respect to it.

Other questions include the important one of endurance. It is quite easy to understand that according to the simple "Law of Currents" the bird should be able to reach no further than the circumference of a circle of 180 miles radius drawn round a centre 120 miles south of the starting point, so that the bird could make a stipulated journey of as much as 100 miles on no course nearer the northward than seventy degrees from the north; but at the same time it would be an error to assume that the natural, actual wind may be no better for the bird than a structureless sliding of the whole atmosphere over the landscape, every part at the same steady velocity of twenty miles an hour from the north. To mention only one of several things, the lower strata of the air are so retarded by surface friction, that the northward flying bird of the example is able to steer obliquely upwards into faster and faster moving air, and literally—Professor Patten's expressive term—"pierce the wind," without experiencing the ordinary calm-air loss of headway. Then it is able to steer down sufficiently to maintain its headway and then rise again, and so proceed northward, even against the wind, in a relieved if not effortless undulatory flight, of undiminished headway with respect to the air. Precisely calculable particulars of this kind of soaring, with further references, may be found in *Nature* of 25th July, 1925, in a communication over the present writer's name.

Of course, such comparatively fatigueless flight may extend far beyond the ordinary calm-air endurance limit, which is supposed to be only six hours for this bird, and many a bird able to obtain some food at intervals may be liking a head wind better than a dead calm. This form of fatigueless flight is brought into the present argument because it is so conspicuously exhibited by the gulls and albatrosses, not least on those occasions when we may, as Professor Patten advises, "watch a herring-gull, on outspread motionless pinions, sail into the teeth of a tempest and then float onward in calm but progressive flight." But the keenly alert and practised bird does not confine itself to that one mode of soaring. It is continually *feeling* other *variations* in the wind, and with as admirable, but delightfully understandable, skill and intelligence using them also to ease its flying.

Yours faithfully,

London. S. L. WALKDEN.

9*th September*, 1927.

AN ANCIENT FUNERARY URN.

To the Editor of DISCOVERY.

SIR,

I beg to enclose a photograph, taken this month by my husband, of a funeral urn found during building operations at Slapton, South Devon, which may be of interest to your readers. The urn was found about eight feet below ground in a field on a hilltop, in view of the sea, with a south-east aspect. With it were a larger urn, unfortunately broken, though many pieces were collected and I hope will be put together, and a thigh bone, also disappointingly destroyed. Whether this was human or not I could not ascertain. The height of the urn is about eight inches; it is imperfectly fired, being reddened on the inside and outside, but with a black core. Only a small triangular

piece is missing from the rim. It is tied with string to give additional support. Permission was kindly given for the photograph to be made by Mr. Heyate, to whom the field belongs.

Yours faithfully,

GEORGINA RACKHAM.

Merle Common, Oxted, Surrey.

Mr. E. N. Fallaize adds the following note :—

"The find recorded by Mrs. Rackham is of considerable interest, and it is hoped that it may be possible to make investigations on the spot which may bring to light further evidence. The pot is a very well-preserved example of a fairly familiar type of funerary urn which it was customary to include in the grave furniture at burials of the dead. It dates probably from the late Bronze or early Iron Age."

Royal Anthropological Institute.
16*th September*, 1927.

"THE SITE OF THE GLOBE PLAYHOUSE."

To the Editor of DISCOVERY.

SIR,

You ask, "Will the memorial tablet now be moved?" referring to the one that records, "Here stood the Globe Playhouse." Assuredly not, for anything done would involve that the Hubbardans really have convinced the Brainy'uns—sorry, I mean the Braineans—or *vice versa*, and that clearly is beyond the expectation of man.

The trouble is that each book or pamphlet that comes out brings complete conviction. Its arguments are absolutely clinching. I have been on this question with Dr. Wallace, Dr. Martin, Mr. Hubbard and Mr. Braine in turn, fully convinced by each; and Mr. Hubbard having been the last to write (in *Discovery*), to-day I am with Mr. Hubbard. But my conviction stands in trepidation for the time when Mr. Braine shall produce his third book on the site of the Globe Playhouse.

The fact must be that this twenty years old wrangle is no more capable of settlement than is the authorship of the "Letters of Junius" or the problem of perpetual motion. Now if only someone would alter the tablet's wording to "Hereabouts stood the Globe Playhouse" all would be peace, and I could imagine Mr. Hubbard, Dr. Martin, and Mr. Braine sitting down amicably to a nice cup of tea.

Faithfully yours,

Wandsworth Common. WALTER G. BELL.
14*th September*, 1927.

THE TEMPERING OF COPPER.

To the Editor of DISCOVERY.

SIR,

In your June issue it is remarked that the modern world has lost the art of tempering copper. ("New Excavations at Ur," page 178.)

A few of us in this little township meet once a month for talks on various subjects, and some years ago this same statement was made by our doctor. I denied it, and after considerable discussion it was decided that I should be asked to find out the true facts about tempering copper when I was in England in 1924.

After trying various people, eventually Sir Flinders Petrie kindly interviewed me at the London University Museum. He showed me old Egyptian tempered copper, and told me that experimentally he had had copper tempered just as hard as any from Egypt, which actually was not tempered very hard.

Now, in *Discovery*, we have an archaeologist of note saying the opposite. Of all the lost, or supposed lost, arts and crafts there is none that is talked about so much, and is not the subject of sufficient interest to merit an article which will definitely clear up the matter in print?

With all good wishes from across the seas,

Yours sincerely,

Morndoo, Kelmscott, CLAUDE L. PIESSE.
Western Australia.

Our correspondent's problem is touched upon in Garland and Bannisters' book "Ancient Egyptian Metallurgy." His letter was forwarded to Sir Flinders Petrie, who writes :—

"There are frequent claims made, on *a priori* grounds, that Egyptians must have had hardened copper, or iron, or steel, to sculpture hard stone. None of these materials would do the work. For rough dressing, stone ball-hammers were used; for finer work, saws and drills of copper were the tools, fed with emery powder, or with emery points inserted. Emery was used in Egypt from prehistoric times."

"THE ORIGIN OF LANGUAGE."

To the Editor of DISCOVERY.

SIR,

Does not Sir Richard Paget somewhat overstrain his theory (quoted from *Psyche* in your September issue) when he writes as though he would have us believe (1) that the familiar "ta-ta" is one of the words "invented by children," and (2) that it is merely a matter of combined tongue-clicking and hand-wagging?

More than thirteen centuries ago "ta-ta" was an old-established Saxon word of affection and endearment applied indifferently to all such persons as were deemed worthy of it, whether children or adults, and was not necessarily accompanied by any motion of the hand. For example, the charming grown-up Princess Ethelburga was always known within her own home circle by the name of "Tata"—which means "the darling" or "well-beloved." Thus, just as the Welsh slave nurse taught her infant charge—without any hand-flapping—to call its father "dad" or "daddy" (in a Welsh church you may see the Lord's Prayer inscribed on one side of the altar, beginning *Ei Thad*—"Our Father") and not by the Saxon word "Fader"; so the Saxon mother saluted her babe with the title "ta-ta" on its going or returning, sometimes lightly waving her outstretched hand in order to attract the child's attention.

Yours faithfully,

10*th September*, 1927. C. E. SHELLY, M.D.

CITY TOURS FOR READERS.

To the Editor of DISCOVERY.

SIR,

We had a great treat yesterday afternoon at Stationers' Hall under the quite perfect guidance of Mr. Walker, and we finished up very enjoyably with tea at Bouverie House. Three friends who accompanied me wish to join in this expression of very best thanks.

Yours faithfully,

Tulse Hill Park, S.W.2. J. MITCHINSON.
14*th September*, 1927.

Book Reviews.

Eruptive Rocks. By S. J. SHAND. (Thos. Murby & Co., Edinburgh. 20s.).

In writing this book, Dr. Shand has done a great service to all students of igneous rocks, and the advanced research worker as well as the young beginner will find ample material for digestion. On the whole the book is rather technical, but it gives an excellent idea of the trend of modern thought in petrology.

At the present time the student of igneous rocks is confronted with many interesting problems. It is generally held that the large masses of granite now exposed at the surface, such as the huge mass of Dartmoor in Devon, were once in a molten state. In this state they were pushed or intruded into the overlying rocks, under the cover of which they cooled, and gradually assumed their present form and texture. The removal of the once overlying strata by the ordinary processes of denudation, has exposed these masses in their present form. During the last hundred years the various experimental geologists have succeeded in producing in the laboratory close imitations of most types of igneous rocks, but nobody has yet prepared an artificial granite. This failure was explained for a long time by the thought that the conditions under which granite consolidated were such that it was impossible to produce them in the laboratory. Recent work, however, has explained the failure in a different light.

The intrusion of a large mass of molten material into the midst of ordinary rocks, produced a number of changes which are still observable. Thus, the rocks around a granite mass are often characterized by containing a number of minerals foreign to the unaltered rock. Further, it has been found impossible to produce such minerals from an ordinary specimen for the very simple reason that they contain elements which are entirely absent from the unaltered rock. Consequently we are led to the conclusion that these minerals must have been produced in the rock by the action of vapours given off from the cooling granite. These so-called volatile constituents were also responsible for the manner in which the molten mass cooled, in that they allowed in some mysterious way of the formation of granite. It is reasonable to suppose that the molten magma during its intrusion would melt portions of the country rock and assimilate them into its own body. This process of assimilation would, of course, alter the intruded rock to an extent proportionable to the amount incorporated. The determination of the degree of alteration of the original magma is at the same time fascinating yet difficult. A third problem of petrogenesis is the attempt to understand the course of consolidation of a magma, and this is one of the most difficult of all the problems.

The first half of the book is taken up with a discussion of these various problems, and the reviewer knows of no other book in which they are discussed in so excellent a manner. This is undoubtedly the part of the book with the widest appeal, for there is not a dull page in it. The author's personal enthusiasm diffuses itself over all the chapters, so that the reader feels he is in direct touch with a man who is an authority on his subject.

In proposing a new system of classification for the igneous rocks, and using it in a systematic account of the various types, Dr. Shand has done a bold thing. Not that the methods now in use are good enough, far from it, but the man who hopes to unravel the almost hopeless muddle known as petrological nomenclature must be possessed of unbounded optimism and untiring energy. Time alone will show whether the new system is better than the older ones, and although it is rather complicated it must be remembered that a complicated system is necessary for a complicated subject. The classification is based primarily on the mineralogical composition of the rocks, with secondary criteria in the texture and ultimate chemical composition. This part of the book, however, is for the student, rather than the general reader.

Chapters on the rock-forming minerals, on ore-deposits, and on meteorites, add greatly to the general interest of the book, and contain much valuable material. In attempting to purify our nomenclature Dr. Shand errs somewhat on the enthusiastic side, for he attempts to substitute new terms in the place of old and well-established ones. Thus, even the title of the book is misleading, for it suggests a treatise on the lavas alone, whilst the book covers the whole field of the igneous rocks. A simplified nomenclature is greatly to be desired, but it will serve no real purpose to abandon old and generally accepted terms for less common or even for quite new ones; better modify the definitions of the old terms and retain them than introduce new words into an already overcrowded nomenclature.

The book is beautifully produced and printed, and a copious list of references at the end of each chapter compensates for the lack of an authors' index.

Melanesians of the South-east Solomon Islands. By W. G. IVENS, M.A., Litt.D. (Kegan Paul. 30s.).

Dr. Ivens' study of the inhabitants of the village of Sa'a, Little Mala, and of the island of Ulawa in the Solomon Islands, is in every way a model of the method of investigating the social anthropology of a primitive people. He was appointed a research student of the University of Melbourne in 1924, and in that capacity spent some months in the islands. This, however, was not his first experience of the people; he had already been in the service of the Melanesian Mission for some thirteen years, and he had published a study of their languages. It is, therefore, not surprising that in the relatively short time he spent on the intensive study of the two areas, he was able to acquire a mass of information which is embodied in the present volume. It is, indeed, one of the most important contributions to Melanesian studies of recent years. Codrington, in his classical work on the Melanesians, had dealt with the islands of Mala or Malaita, but of Ulawa little was known. Dr. Ivens has added much that is new to our stock of knowledge, and in amplifying what was already known, has taken us a considerable stage further towards elucidating the great problem of Melanesian ethnology—the disentangling of the complex of cultures in the various areas of distribution of these primitive peoples. As an example of Dr. Ivens' achievement in this field may be mentioned his study of the very remarkable superimposition of another cult upon the ancestor worship characteristic of Melanesian peoples. Here there is found incorporated in ancestor worship a cult of sea spirits who are not regarded as ancestors. In all probability the cult is to be explained, as Dr. Ivens suggests, as the transmuted memory of an Indonesian immigration in much the same way as the coming of the white man survives in Polynesian tradition. With equal skill and discernment Dr. Ivens has disentangled the peculiar features in which these peoples depart from type in their social organization and marriage regulations, the chieftainship and the priesthood. He gives a very full and

detailed account of the system of annual sacrifices. Magic and incantation, as might be expected, figure largely. Dr. Ivens' work, it may confidently be predicted, will become a standard book of reference for the student, but it is also of absorbing interest to all who seek to know the mentality and life of strange peoples.

The Mothers: A Study of the Origins of Sentiments and Institutions. Vols. I—III. By ROBERT BRIFFAULT. (Allen & Unwin. 25*s.* each volume).

Marriage and the position and function of women are admittedly of fundamental importance in the organization and development of human society. A multitude of data bearing upon questions relating to both have been collected from all grades of culture, and a vast amount of literature has been produced about them. It need, therefore, cause no surprise that Mr. Briffault's extended study reaches 2,400 pages, of which 200 comprises his bibliography. He has drawn his net wide—a mere summary of the topics he discusses would run to more space than is available here—but there is little if anything in his book which is not truly relevant to his argument. For he holds that the social characters of the human mind are one and all traceable to the operation of instincts that are related to the female and not the male. The effects of this conception are traced through the whole gamut of social functions and its operation delineated in the development of industrial, economic, religious and moral ideas. Marriage institutions in the wider biological and sociological sense naturally take a prominent place in this survey.

To those who are acquainted with the literature, it will be apparent from the outset that Mr. Briffault virtually returns to the original position of Backofen, McLellan, and Morgan—the writers first to put forward views on the preponderance of woman in the primitive organization of society; and does not follow later writers who have accepted these views with modification or even rejected them in whole or part. He is frequently, for instance, at odds with Professor Westermarck. Very briefly, his views may be summarized as acceptance of the maternal horde with promiscuous relations as the original form of human sexual association. Exogamy and matrilocal marriage were devices to support the authority and rule of the mother, and patriarchal and patrilocal marriage, it is held, developed by the institution of the dower or bride price in place of the husband's service, the family developing out of the group as the latter broke down. In other words, the family, in the author's view, connotes a recognition of the place and function of the father. Mr. Briffault supports his views by biological and zoological arguments; but not only are the facts difficult to ascertain with certainty, for there is a conflict of evidence, but they are not always strictly analogous. Further, as Dr. Malinowski's researches have shown, the position of a father is recognized in a matriarchal family notwithstanding the social affiliation of offspring with the mother's family, and the exclusion of the father from the social group as distinct from the family association. It has to be remembered in such discussions on the origin of marriage and the family that the group marriage and primitive promiscuity are at best hypotheses which have been formulated to explain certain customs as survivals; but these customs may well have an entirely different origin, as a reference to other writers will show.

Although we may not agree with Mr. Briffault in all his views, his erudition is vast and he has brought together an enormous number of facts which make his book a storehouse for reference. His interpretation of early Irish civilization, and the romance and chivalry of the Middle Ages in the light of his theories are both instructive and entertaining. Unlike many books of its kind, notwithstanding the multitudinous details, "The Mothers" is anything but tedious to read.

Books Received.

The Effects of Music. A Series of Essays edited by MAX SCHOEN. (Kegan Paul, Trench, Trubner & Co. Ltd. 15*s.*).

British Museum Quarterly. Vol. II. No. 1. (Published by the Trustees. 2*s.*).

The Spinning of Aeroplanes. By S. B. GATES, M.A., and L. W. BRYANT, B.Sc. (H.M. Stationery Office. 6*s.* 6*d.*).

Picture Postcards. Set C 19. (British Museum: Natural History. 1*s.*).

Easy Lessons in Wireless. By R. W. HUTCHINSON, M.Sc. (University Tutorial Press. 1*s.* 6*d.*).

Statics and Dynamics of a Particle. By PROFESSOR W. D. MACMILLAN, M.A., Ph.D. (McGraw Hill Publishing Co. Ltd. 25*s.*).

Conditioned Reflexes: An Investigation of the Physiological Activity of the Cerebral Cortex. By I. P. PAVLOV, For.Mem.R.S. Translated and edited by G. V. ANDREP, M.D., D.Sc. (Oxford University Press. 28*s.*).

Motherhood and its Enemies. By CHARLOTTE HALDANE. (Chatto & Windus. 6*s.*).

Evolution Re-Interpreted. By H. REINHEIMER. (Grevett & Co. Ltd. 3*s.* 6*d.*).

Fire Resistant Construction. Department of Scientific and Industrial Research, Building Research Special Report. No. 8. (H.M. Stationery Office. 1*s.* 6*d.*).

Illustrations of the Methods of Reasoning. By DANIEL S. ROBINSON, Ph.D. (D. Appleton & Co., New York. $2.00).

Elementary Physical Chemistry. By HUGH S. TAYLOR, D.Sc. (Macmillan & Co. Ltd. 16*s.*).

Logic and Law in Biology. By P. CHALMERS MITCHELL, C.B.E., M.A. (Macmillan & Co. Ltd. 1*s.*).

Mendelism. By REGINALD GRUNDALL PUNNETT, F.R.S. (Macmillan & Co. Ltd. 8*s.* 6*d.*).

Local Geology. By DR. A. MORLEY DAVIES. (Thomas Murby & Co. 1*s.*).

The Farmer's Dilemma. By the RT. HON. SIR FRANCIS ACLAND, Bart. (The Land and Nation League. 6*d.*).

Hymen, or the Future of Marriage. By NORMAN HAIRE. (Kegan Paul, Trench, Trubner & Co. Ltd. 2*s.* 6*d.*).

Agricultural Parasitology. By C. L. WALTON and W. REES WRIGHT. (Sidgwick & Jackson Ltd. 6*s.*).

London University Guide and University Correspondence College Calendar. (University Tutorial Press. 2*s.* 6*d.*).

Money and Monetary Policy in Early Times. By A. R. BURNS, B.Sc. (Econ.). (Kegan Paul, Trench, Trubner & Co. Ltd. 25*s.*).

Father or Sons? A Study in Social Psychology. By PRYNCE HOPKINS, M.A., Ph.D. (Kegan Paul, Trench, Trubner & Co. Ltd. 12*s.* 6*d.*).

Galatea, or the Future of Darwinism. By W. RUSSELL BRAIN. (Kegan Paul, Trench, Trubner & Co. Ltd. 2*s* 6*d.*).

Thermionic Phenomena. By EUGENE BLOCH. Translated by J. R. CLARKE, M.Sc. (Methuen & Co. Ltd. 7*s.* 6*d.*